

# Radio, Electronics and Communications

FORMERLY "RADIO & ELECTRICAL REVIEW" — WIDELY KNOWN SINCE 1946 AS "R. & E."



## In This Issue . . .

- Looking At Column Speakers
- A Noise Limiter
- Simple Transistorised Audio Oscillator
- Circuit and Service Data
- Index to Volume 19
- Mobile Communications — Part I.

PUBLISHED MONTHLY IN THE INTERESTS OF THE N.Z. ELECTRONICS INDUSTRY FOR ALL LEVELS, FROM PROFESSIONAL TO AMATEUR.

VOLUME 20

NUMBER 2

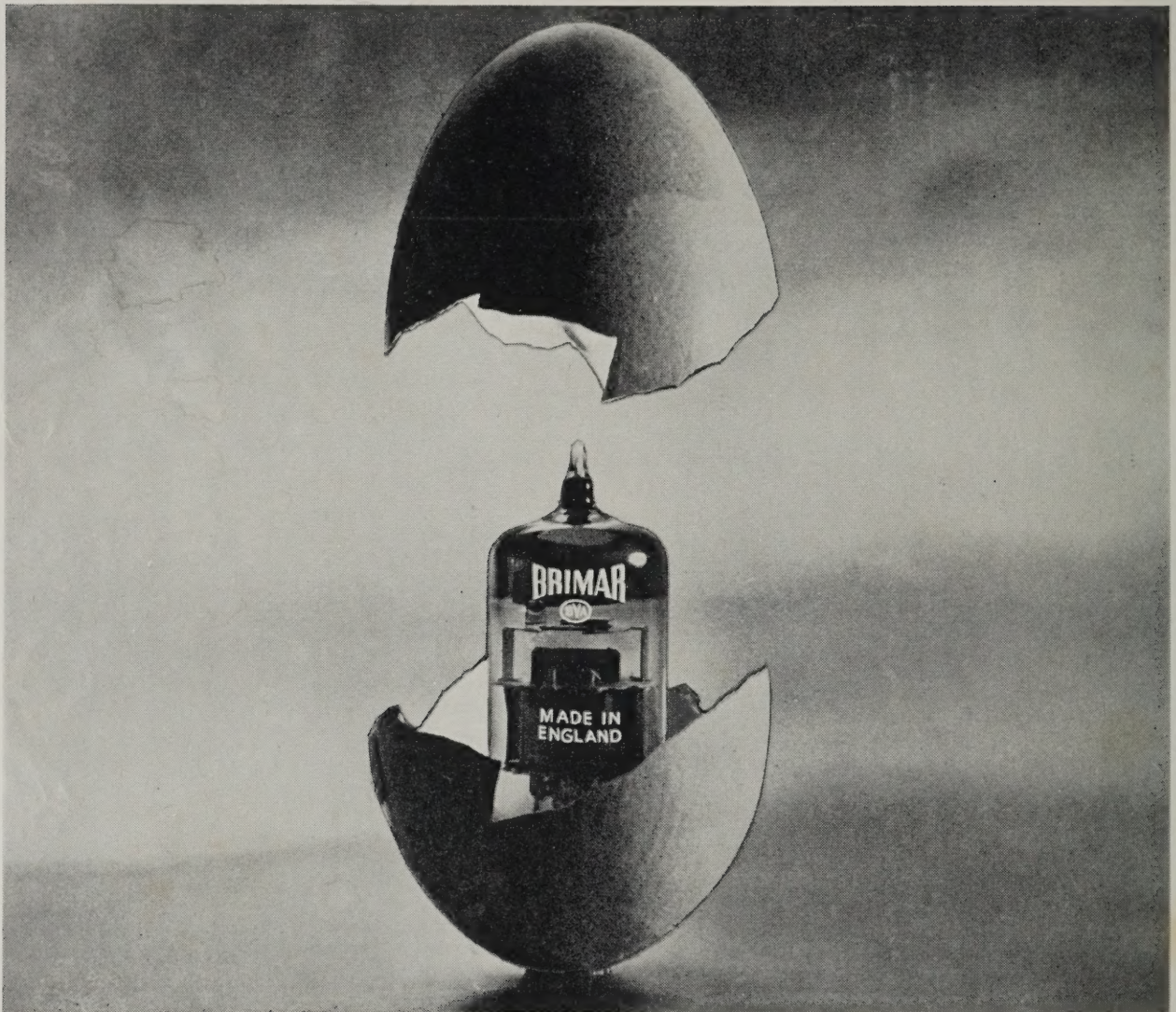
APRIL 1, 1965

PRICE 2/6



AWA engaged for Major Electronic Refit of U.S.N.S. "Eltanin"

ENQUIRY CARD AD. 1



The shell of an egg contains the secret of reproduction. So too, in a different sense, does a Brimar valve. For true-to-life reproduction and consistent reliability,

**better rely on -**



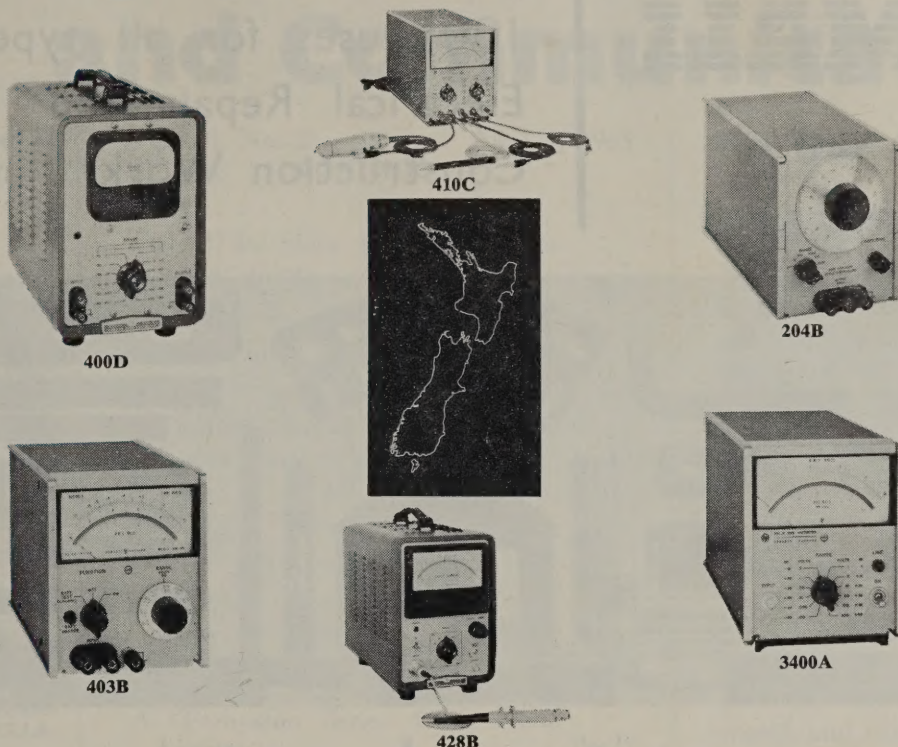
N.Z. Distributors:-

*Standard Telephones and Cables (Pty.) Limited* <sup>AN</sup> **ITT**  
ASSOCIATE

B.14

Auckland, Box 571; Upper Hutt, Box 140;

# hp goes on tour . . .



## these quality instruments will soon be travelling New Zealand

### 204B OSCILLATOR

Frequency range: 5c/s - 560kc in 5 ranges  
Vernier control.

Dial accuracy:  $\pm 3\%$ .

Output voltage: 2.5V RMS in 600 $\Omega$ .

Distortion: less than 1%.

Noise: less than 0.05% Mains or Battery operated.

Stability: 5 in  $10^4$  at 560kc.

Size: 6 3/32" high, 5 1/8" wide, 8" deep.

### 400D VACUUM TUBE VOLTMETER

Voltage range: 1mV to 300 Volts.

Frequency range: 10c/s to 4mc/s.

Accuracy:  $\pm 2\%$  20c/s - 1mc/s.

$\pm 3\%$  20c/s - 2 mc/s.

$\pm 5\%$  10c/s - 4mc/s.

Input impedance: 10m $\Omega$  and 15 pf. on 1V to 300V ranges. 10m $\Omega$  and 25 pf on 0.001 to 1V ranges.

### 403B AC VOLTMETERS

Voltage range: 1mV - 300 Volts.

Frequency range: 5c/s to 2mc/s.

Accuracy:  $\pm 2\%$  10c/s - 1mc/s.

$\pm 5\%$  5 to 10c/s and 1 to 2mc/s.

Input impedance: 2m $\Omega$  and 50 pf on 1mV to 30mV and 25 pf on 1V to 300V.

### 410C ELECTRONIC VOLTMETER

DC Voltmeter:  $\pm 15$ mV to  $\pm 1500$ V.

Accuracy:  $\pm 2\%$ .

Input resistance: 100m $\Omega$  500mV and above.  
10m $\Omega$  150mV and below.

DC Ammeter:  $\pm 1.5\mu$ A to 150mA.

Accuracy:  $\pm 3\%$ .

Input resistance: 9k $\Omega$  on 1.5 $\mu$ A to 0.3 $\Omega$  150mA

Ohmmeter: 10 $\Omega$  to 10m $\Omega$  (centre scale).

Amplifier: Voltage gain = 100.

AC rejection 3dB at  $\frac{1}{2}$ c/s.

66dB at 50c/s.

Output: 1.5V DC at FSD current 1mA (linear)

AC Voltmeter: 0.5V to 300V.

Accuracy:  $\pm 3\%$  at 400c/s.

Frequency response: 20c/s to 700mc/s.

Input impedance: more than 10m $\Omega$  at low frequencies and 1.5 pf.

### 428B CLIP-ON DC MILLIAMMETER

Current ranges: 0.1mA to 10A.

Accuracy:  $\pm 3\%$ .

Probe inductance: less than 0.5 $\mu$ Hy.

Probe induced voltage: less than 15mV peak.

Bandwidth: DC - 400c/s.

### 3400A TRUE RMS VOLTMETER

Voltage range: 1mV to 300V.

Frequency range: 10c/s to 10mc/s.

Accuracy:  $\pm 1\%$  50c/s - 1mc.  $\pm 2\%$  1-2mc/s.

$\pm 3\%$  2-3mc/s.  $\pm 5\%$  10-50c/s, and 3-10mc/s.

Response: RMS value, all waveforms

Crest factor: 10:1 Full scale. 20:1  $\frac{1}{2}$  scale.

100:1  $\frac{1}{10}$ th scale.

Input impedance: 10m $\Omega$  1mV-300mV and 40 pf.  
10m $\Omega$  and 15 pf on 1-300V.

Output: Negative 1V at FSD linear at 1000 $\Omega$ .

**IF YOU ARE INTERESTED ENSURE A VISIT—WRITE OR PHONE NOW**

**HEWLETT *hp* PACKARD**  
An extra measure of quality

N.Z. agents:

**Sample Electronics (N.Z.) Ltd.**

8 MATIPO STREET, ONEHUNGA, S.E.5, AUCKLAND

NEW ZEALAND

TELEPHONE 565-361

If you wish to contact Mr. D. Barlow during his tour his itinerary is as set out below:—

May 17 — Commercial Hotel, Hamilton  
May 18 - 19 — Wairakei Hotel, Wairakei  
May 20 - 21 — Carlton Hotel, Palm. North  
May 22 - 25 — St. George Hotel, Wellington

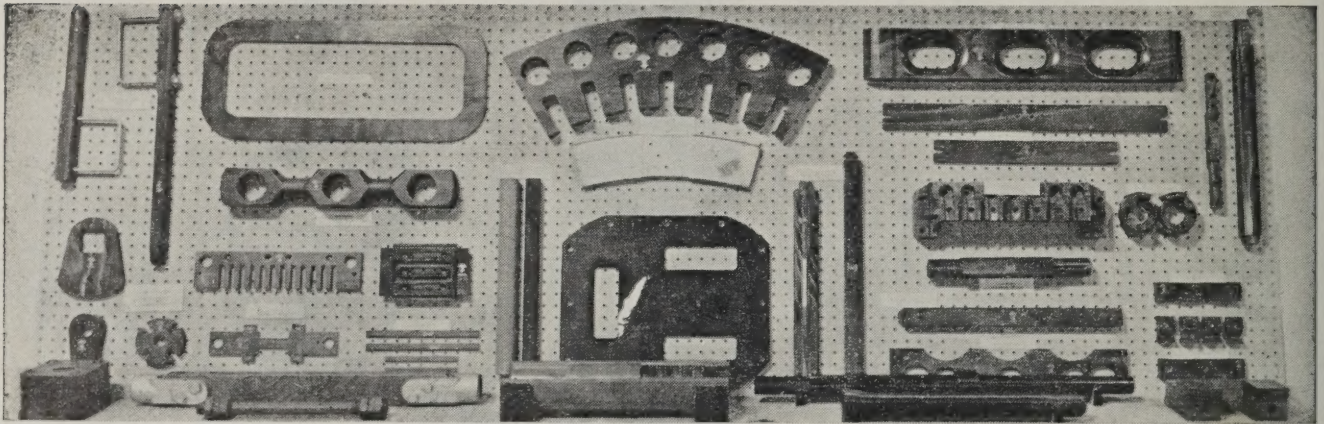
May 26 — Late booking ferry to Lyttelton  
May 27 - 28 — Coker's Hotel, Christchurch  
May 29 — Hydro Grand Hotel, Timaru

May 30 - June 1 — Grand Hotel, Dunedin  
June 2 — Coker's Hotel, Christchurch  
June 3 — Return Wellington—Ferry  
June 4 — St. George Hotel, Wellington

ENQUIRY CARD AD. 3

**PERMALI**

The insulating material with  
1001 uses for all types of  
Electrical Repair and  
Construction Work.



**PERMALI** is a light, strong, densified laminate which combines excellent dielectric and mechanical properties.

**PERMALI** is equally suitable for large or small components. As the illustration shows, there is no practical limit to the machining possibilities. Easily drilled, sawn, threaded, or machined, it is ideally suitable for the fabrication of electrical components and assemblies, wherever a combination of strength with insulation is required.

Keep a few Permalite sheets and rods handy in the Workshop. They will save you time and trouble on dozens of repair and "one-off" jobs—and ensure first-class results every time.

*Available Ex Stock :*

## PERMALI PANELS

36 in. x 24 in., 3/16 in., 3/4 in., 3/8 in.,  
1/2 in. thick.  
48 in. x 36 in., 3/8 in., 3/4 in., 1 in.,  
1 1/2 in., 2 in. thick.

## PERMALI RODS

ROUND — 3/4 in., 5/16 in., 3/8 in.,  
1/2 in., 3/4 in., 1 in., 1 1/2 in.,  
1 3/4 in., 2 in. diameter.

SCREWED ROD — WHIT.  
5/16 in., 3/8 in., 1/2 in., 3/4 in., 1 in.,  
1 in. Also nuts to fit.

**ORDER A TRIAL SUPPLY  
TODAY!**

**N.Z. AGENTS :**



**E. C. GOUGH LTD.**

P.O. BOX 873 — PHONE 62-254 — CHRISTCHURCH  
P.O. BOX 8150 NEWTON — PHONE 16-100 — AUCKLAND



**Formerly Radio and  
Electrical Review**

(Established 1946)

**CONSULTANT EDITORS:**

C. W. Salmon, M.N.Z.I.E.,  
Grad. I.E.E., Assoc. I.E.R.E.

I. H. Spackman, A.M.I.E.E.E.

P. L. Watts  
representing  
N.Z. Electronics  
Institute

**EXECUTIVE EDITOR:**

Robin H. E. Beckett.

\* \* \*

Published Monthly by the  
Proprietors:

**THE MAGAZINE PRESS LTD.,**

Publishers also of  
HOME AND BUILDING

Director and Chairman:

Victor L. Beckett  
A.A.I.(Aust.), Hon.A.N.Z.I.A.

Director and Secretary:

Wilma W. Beckett

Production Manager:

Robin H. E. Beckett, B.A.

at the Registered office of the  
company, Employers Associa-  
tion Building, 157 Khyber Pass,  
Auckland, C.3. N.Z. P.O. Box  
1365, Auckland. Telephone 41-  
508, 41-519.

**OFFICIAL JOURNAL OF**

**The New Zealand Electronics  
Institute (Inc.)**

Secretary: J. L. McKie,  
P.O. Box 1506, Christchurch.

\* \* \*

Sole New Zealand Distributors:

GORDON & GOTCH (N.Z.)  
LTD.

From Newsagents — 2/6 per  
copy. Or direct from the pub-  
lishers 30/- per year in ad-  
vance, post free throughout the  
world.

\* \* \*

Advertising Representatives for  
the United Kingdom:

**PUBLISHING & DISTRIBUTING  
CO., LTD.,**

177 Regent St., London, W.1.

\* \* \*

Printed by Farrell Printing  
Ltd., Mt. Roskill, Auckland.  
Registered as a newspaper at  
the G.P.O., Wellington.

Vol. 20, No. 2

April 1, 1965

**CONTENTS**

**Editorial . . .**

Code 57:02 Ships' Rockets . . . and  
similar things . . . . . 7

☆

Looking at Column Loudspeaker  
Systems . . . . . 9-11

Instruments to Test and Monitor  
Communications Equipment . . . 13-34  
*By J. Stubbs Walker*

A Simple Transistorised Audio  
Oscillator . . . . . 16-17

Technician Training . . . . . 18-37  
*By V. M. Stagpoole*

Bell Circuit and Service Data . . . 19-22

A Transistor Series Gate Noise  
Limiter . . . . . 26-27  
*By Irving Spackman*

Mobile Communications — Part I . . 29  
*By "Countryman"*

Design of a  $\frac{5}{8}$ th Wavelength Whip . . 30-31  
*By Irving Spackman*

A.W.A. refit of U.S.N.S. Eltanin . . 33

INDEX to Volume 19 . . . . . 36

☆

**Departments**

Letters . . . . . 5

Serviceman's Column . . . . . 23  
*By J. Whitley Stokes*

Listening Post . . . . . 31  
*By Michael Lawrence*

Book Review . . . . . 35

Enquiry Service Form . . . . . 38-39

New Products . . . . . 38-40

**On Our Cover**



**AWA Refits U.S. Ship**

Featured on this month's cover is a radio room of the U.S.N.S. Eltanin, currently engaged in research and exploration in Antarctic waters. Newly fitted electronic equipment is shown undergoing final testing by Amalgamated Wireless (Australasia) N.Z. Ltd. engineers. The company was awarded the contract for an electronic refit of the ship following an inspection of N.Z. facilities and personnel by U.S. Naval authorities.

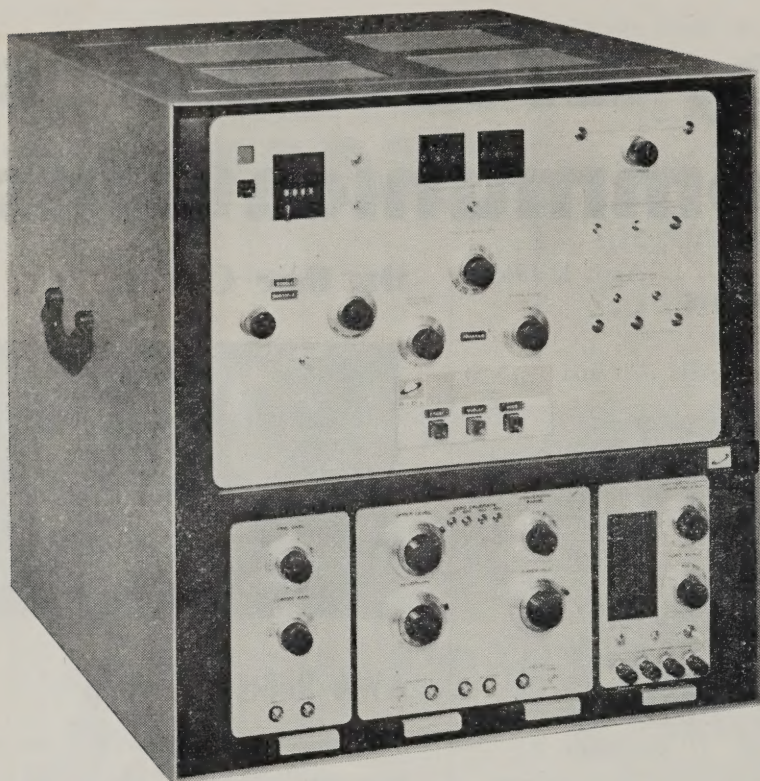


**Also . . .**

Circuit & Service Data  
Listening Post  
Book Review  
Serviceman's Column  
New Products

**COMING . . .**

Wide Band Balancing Transformer  
Communications Series — Part 2  
D.D.D. Ring  
Medical Electronics  
Electrical Units & Standards  
V.H.F. Convention Report



## New Family of Multichannel Analyzers Introduced by RIDL Offers a Totally New Concept in Analyzer Design

RIDL'S line of Expansible Project-Matched Instruments now includes the 34-27 SERIES SCIENTIFIC ANALYZER SYSTEMS. The 34-27 Series is a family of analyzer systems each of which is tailored to a specific application. It is not limited to multichannel pulse height analysis alone, but expansible to include such applications as Mossbauer, NMR, Pulsed Neutron, Time of Flight, Spectroscopy, etc.

The system concept centres around a basic 400 word memory with wired programme master controls. Modules for specific requirements such as input amplifiers, analog-to-digital converters, display controls, and system power supplies have been packaged permitting complete flexibility. ADC's with and without buffered outputs are available. Several Display Control modules are available offering such things as vertical display offset of subgroups or typewriter drive circuitry.

Standard features of the Scientific Analyzer Systems include Region-of-Interest logic for data display and readout, internal time base for time sequence scaling, elapsed time storage and readout, flexible preset count control, pushbutton control logic, and X-Y plotter calibration. Optional features include such things as spectrum stripping and peak area integration. Optional accessories are practically unlimited.

RIDL, a division of Nuclear-Chicago Corporation, is a leading producer of modular nuclear instruments and multichannel and multiparameter analyzers.

N.Z. AGENTS:

**SAMPLE ELECTRONICS (N.Z.) LTD.**

8 MATIPO STREET, ONEHUNGA, S.E.5, AUCKLAND, NEW ZEALAND

TELEPHONE 565-361



**RIDL** RADIATION INSTRUMENT DEVELOPMENT LABORATORY, A DIVISION OF NUCLEAR-CHICAGO CORP.

SERVICE AND  
CALIBRATION  
FACILITIES  
AVAILABLE

## Letters from Readers

Wearily, or perhaps it should be warily, I take up my cudgel to do battle with you over an exceptionable statement in the March editorial.

It is all very well for you Sir, ensconced in your editorial chair to dispense gratuitous advice on how the New Zealand electronics industry should conduct its affairs. But I have a feeling that you are out of touch.

Regarding the remark — "Surely the relatively few items so imported should be a spur to local industry to raise its manufacturing standards even if prices cannot be met entirely."

Firstly the "relatively few" items are in fact, relatively many. Admittedly this is not due solely to those items, mainly transistor radios, which have been brought back from overseas legitimately, although even here there is a good deal of trafficking going on. Closing the gap here would still leave the large numbers of smuggled and Customs Dept. confiscated sets unaffected. My own estimate of the proportion of Japanese sets to be found in the Auckland area is 75 per cent of all transistor radios in use. This estimate is based on the number of radios brought in to have new batteries fitted plus the number noticed during house

calls for TV service.

Secondly the idea that these "items so imported," should be a spur to local industry to raise its manufacturing standards will I am afraid be greeted with raised eyebrows if not hoots of derision.

After seeing many hundreds of these "imports" I am left in no doubt of the ability of local industry to produce a better quality article. At least that used to be the case, for nowadays we are rapidly reaching the stage where our designs are handed to us on a platter as what with "made under licence" on one hand and the large Japanese component content on the other we may soon reach the stage that anything other than Japanese is unknown in the manufacture and sale of transistor radios.

Incidentally neither the cameras or small TV sets mentioned are manufactured in this country so that the remarks concerning local industry cannot apply to them.

J. W. STOKES,

Auckland.

**Thank you for your comments. We publish this letter this month for the information of other readers who may be interested in our editorial comments. The author is at the moment investigating — watch for his reply next month.**

—Ed.

### DEATH OF DISTINGUISHED WIRELESS PIONEER

**C. S. Franklin, C.B.E., M.I.E.E.**

'The father of modern radio telecommunications'

It is with regret that we record the death of Charles Samuel Franklin, the father of modern radio telecommunications and one of the greatest pioneers after Marconi himself. His quiet persistence and stubborn refusal to accept face values led to the largest single contribution to modern telecommunications that Britain has ever known.

Born in Walthamstow, Essex in 1879, Charles Franklin was the youngest of a family of thirteen. His engineering and scientific training took place at the Finsbury Technical College where he studied under Professor Silvanus Thompson.

In 1899 he joined Marconi's and almost immediately left for South Africa and the Boer War to help introduce wireless to the battlefield. His first close contact with Marconi himself came in 1902 when the two of them sailed across the Atlantic in the Philadelphia, successfully receiving transmissions from Poldhu in Cornwall, at ranges of up to 1550 miles.

Then followed two years of demonstrating radio equipment in Russia. On return to Britain he began a long personal association with Marconi, the two of them often working late into the night on experimental ideas. During the eight years from 1908-16 much of their work was done in the isolation of the wireless stations, dotted around the coasts and it was in this period that Franklin was at his happiest.

In 1916 Franklin and Marconi started their first experiments into short-wave communications, Franklin designing a special spark transmitter operating in compressed air. Some highly promising results were obtained from their initial experiments and they eventually led to the first beamed short-wave system in the world. This was the greatest breakthrough in radio communications since the spanning of the Atlantic in 1901 and the forerunner of all today's complex communications facilities. In fact, some of Franklin's designs are still in use providing h.f. communications to this day.

For the rest of his career with the Marconi Company, Franklin concentrated on the development of his short-wave

## RECENT BRITISH STANDARDS INTERNATIONAL UNITS

In view of Britain's likely adoption of the metric system, the publication of a British Standard for The International System (SI) Units (B.S. 3763) will command great interest.

The SI units were adopted by the Conference Generale des Poids et Mesures (C.G.P.M.) in 1954 and endorsed by the International Organization for Standardization.

The system has been introduced as the only legal one in France, and it seems likely to be adopted in other Common Market countries and Russia. It will, therefore, become common in many Continental commercial transactions.

The SI dispenses with many U.K. units of measurement. There are only six basic SI units with their associated symbols:— metre (m) to express length, kilogramme (kg) to express mass, second (s) to express time, ampere (A) to express electric current, degree Kelvin (°K) to express thermodynamic temperature and candela (cd) to express luminous intensity.

As well as defining these basic units, the Standard deals with certain derived SI units, including the Newton to express force and the lux to express illumination. In addition, the values of units of measurement commonly used in the U.K. are given in terms of SI units.

## U.H.F. TV RECEPTION PROBLEMS

The British Standards Institution has prepared a supplement to its code of practice on the reception of sound and television broadcasting (CP 327.201) to give guidance on some of the problems likely to be encountered in u.h.f. reception. It particularly considers the basic requirements for good reception, types of aerial system (including communal aerials and the siting of aerials).

beam system and had even reached a stage, in 1933, where he was experimenting with radar.

He was also closely connected with broadcasting and helped in the design and installation of the famous 2LO, London's first broadcasting transmitter. He designed the first seven masts of the Marconi SWB transmitters, and the aerial system for the world's first regular television service from Alexandra Palace — the original BBC station — was also designed by him.

He retired in 1939, but was appointed a Research Consultant to The Marconi Company. He returned to Poldhu but later moved to the London area where he lived until his death on December 10.

Sixty-five patents stand to Franklin's credit including the variable capacitor, the ganged capacitor, the reaction circuit and the concentric feeder. This last invention is widely used today in practically every household possessing a television set.

He was known and respected by all the early followers of wireless and his death is a great loss to all those who were concerned with the early development of the radio industry.

**ATC****Standard Power Transformers**FOR RADIO AND AMPLIFIERS, AVAILABLE  
IN FLAT OR VERTICAL MOUNTINGS

Except where stated all 230 V. Primary

PT 1	150/150 V	30 Ma.	6.3 V	2 Amp.		
PT 2	220/220 V	40 Ma.	6.3 V	2 Amp.		
PT 3	260/260 V	60 Ma.	6.3 V	2 Amp.		
PT 4	280/280 V	60 Ma.	6.3 V	2 Amp.	5 V 2 Amp.	
PT 5	350/350 V	60 Ma.	6.3 V	2 Amp.	5 V 2 Amp.	
PT 6	115/115 V	65 Ma.	6.3 V	1 Amp.		
PT 7	115/V $\frac{1}{2}$ Wave	65 Ma.				
PT 8	280/280 V	80 Ma.	6.3 V	3 Amp.	5 V 2 Amp.	
PT 9	310/310 V	80 Ma.	6.3 V	3 Amp.	5 V 2 Amp.	
PT 10	350/350 V	80 Ma.	6.3 V	3 Amp.	5 V 2 Amp.	
PT 11	310/310 V	100 Ma.	6.3 V	4 Amp.	5 V 2 Amp.	
PT 12	350/350 V	100 Ma.	6.3 V	4 Amp.	5 V 2 Amp.	
PT 13	310/310 V	125 Ma.	6.3 V	4 Amp.	5 V 3 Amp.	
PT 14	310/310 V	150 Ma.	6.3 V	5 Amp.	5 V 3 Amp.	
PT 15	400/400 V	150 Ma.	6.3 VCT	5 Amp.	5 V 3 Amp.	
PT 16	400/400 V	150 Ma.	6.3 VCT	2 Amp.	5 V 3 Amp.	6.3 V 4 Amp.
PT 17	450/450 V	150 Ma.	6.3 VCT	2 Amp.	5 V 3 Amp.	6.3 V 4 Amp.
PT 18	450/450 V	200 Ma.	6.3 VCT	2 Amp.	5 V 3 Amp.	6.3 V 4 Amp.
PT 19	500/500 V	200 Ma.	6.3 VCT	2 Amp.	5 V 3 Amp.	6.3 V 4 Amp.
PT 20	595/595 V (500 V DC)	350 Ma. Choke Input				
PT 21	890/890 V (750 V DC)	250 Ma. Choke Input				
PT 22	295/295 V	360 Ma.	6.3 V	10 Amp.	5 V 3 Amp.	Sec. Tapped 240/240 V
PT 24	Suitable for use with either RCA or Philips TV Kits Primary 0.210, 220, 230, 240 V. Pri. 0-230-270 V Used in TV Receiver with Mains Rectification.					
			6.3 V	5 Amp.	6.3 V 5 Amp.	5 V 2 Amp.
PT 25	115 V	360 Ma.	12.6 V	5 Amp.	CT used with Silicon Diodes in Voltage Doubler Circuit.	
PT 26	280/280 V	80 Ma.	6.3 V	4 Amp.	6.3 V 1 A.	
PT 27	280/280 V	125 Ma.	6.3 V	5 Amp.	CT 6.3 V 1 A.	
PT 28	280/280 V	175 Ma.	6.3 V	4 Amp.	CT 6.3 V 4 A.	CT 5 V 3 A.
PT 30	104 V	150 Ma.	6.3 V	5 Amp.	CT	
PT 31	126 V	125 Ma.	6.3 V	3 Amp.	CT 6.3 V 3 A.	

SPECIALS MADE TO INDIVIDUAL NEEDS AT LITTLE EXTRA COST.

**Auckland Transformer Co. Ltd.**

20 EDEN STREET, NEWMARKET, AUCKLAND

TELEPHONE 51-307

Telegrams: "TRANSFORMA," Auckland

## Code 57.02: Ship's rockets . . . and similar articles

Any radio or electrical manufacturer or importer who hoped for more liberal treatment in the 1965-66 Import Licensing Schedule will be frustrated by the statement from the two Ministers concerned in its presentation.

Admittedly, our country's overseas funds position is still not secure but the list of items freed, this year, from import control is a curious assembly of trivia. Remembering the various outreries during the past twelve months or so from small pressure groups it would seem that providing the potential import value is small, constant niggling pays off. No doubt the Departments concerned know exactly the likely increase in imports due to the 89 items freed this year but they would certainly not make any importer grow rich on a possible increase in demand, ranging as they do from passover bread through pyrethrum to dome fasteners and artificial eyes. As the demand for these items is fairly stationary by all means free them from import control but let's not have all the humbug about increased imports.

What could an importer and a manufacturer reasonably have expected from this Schedule? Their expectations are not incompatible — a reasonably minded importer faces the fact of life that he cannot import what is fairly made here and the manufacturer does not want to manufacture what cannot fairly be made here. First of all, in our industry classifications there are no increases at all. By and large, considering the entertainment field, this is quite in order as the demand for TV sets is likely to diminish late this year and the group 106 (radio and TV) importers will have sufficient licences in this case. However the industrial and instrumentation demand has not been recognised by any increase in licence values — the few increases in the schedule again appear to be due to pressure group activity — a 10% increase in electric shavers and the same in field and opera glasses and in cinematograph cameras. No shortages of these items has been apparent to us. Yet all readers will know of the shortage of testing instruments such as precision signal generators and cathode ray oscillographs. Import Schedules over the past few years have given increases, or even exemption, for very specific items and there is every reason to liberalise the imports of **precision** measuring and testing instruments.

Firstly the demand is not great and no importer is going to carry 12 cathode ray oscilloscopes at £600 each in stock. He may carry one or two but the great thing would be the obviating of the frustrating delay for licences that now takes place. No one places

an order for £500 or £1000 worth of electronic instrument without good reason yet time and time again the customs department will ask "is it really wanted, what is it wanted for, won't something cheaper do the job?"

The industrial sciences should be fostered in New Zealand but shortages of equipment and delays in obtaining quite modestly priced instruments due to licence delays do not fire the user or designer with enthusiasm. The increasing use of electronic equipment in overseas industries to improve efficiency has even reached the columns of our daily papers yet intending users here still face the "why" questions of the customs department.

Perhaps nine out of ten in the technical side of our industry are New Zealand born and have little wish to leave this country but stories (in fact, not fiction) of less frustrating scientific endeavour overseas, must lure some away. Yet, at one level a solution would not be very costly — liberalisation of import control on **precision** scientific and industrial equipment. We emphasise "precision" for two reasons; because the demand is not great but comes from where it counts and because **simpler, cheaper instruments can be made in New Zealand** and already are being made in this country.

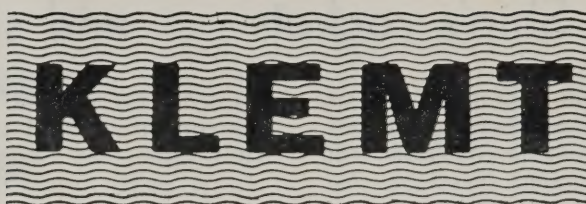
And this is where the local manufacturer of electronic equipment (not entertainment items) receives no help from the 1965/66 schedule, since only one item is a prohibited import — "10 watt general purpose self-contained, mains-operated amplifiers".

Could the customs department please tell us why this could not have been extended to 25 watt including all "non industrial" amplifiers, mains or transistor, mono or stereo. They just may not be able to, through lack of awareness of the state of local design and manufacturing abilities. This is as much the fault of the local manufacturers as of the Customs and Industries and Commerce Departments. To keep our industrial technicians and designers we need the demand for equipment; in the general range this can be had by selective import controls; that this builds up a manufacturer or group is incidental, the keeping of a keen group of technicians and designers is more important to both the civil and military well-being of New Zealand.

Unless the government's awareness of the need to nurture technical personnel increases the industry should import a few ships' rockets (now free of import control) and aim them appropriately.

—W.L.

ENQUIRY CARD AD. 8

**FIELD STRENGTH METER FOR TELEVISION & RADIO TELEPHONE Etc.**

THERE ARE MANY SATISFIED USERS THROUGHOUT NEW ZEALAND AND OVERSEAS.

**FOR** INSTALLING AERIALS.**FOR** SITE TESTING.**FOR** FIELD STRENGTH MEASUREMENTS.**FOR** MONITORING OF TRANSMITTERS.**FOR** INTERFERENCE MEASUREMENTS.**FOR** AERIAL VOLTAGE MEASUREMENTS.**LOOK AT THESE FEATURES . .**

- ★ Continuously tuned coarse and Vernier. Not a TV tuner.
- ★ Full frequency coverage over complete range.
- ★ All transistorised construction.
- ★ Dependable accuracy and repeatability.

- ★ Uses only six torch cells.
- ★ Robust construction housed in robust case.
- ★ Both visual and audible indication.
- ★ Built-in battery check.
- ★ Matching for 70 or 300 ohm. inputs.
- ★ Different models available.

Frequency range: 45-220 mc/s fully adjusted to cover Channel 1-9.

Also two ranges 45-220  
470-960 mc/s

Accuracy: 2% or better.

Bandwidth: 200 kc/s.

Ranges: Three 1mv to 2 volts log.  
10uv to 20 mv log.  
5uv to 200uv lin.Current drain: 15ma with audio off.  
100ma with audio on no scale deflection.  
270ma with audio on and full scale deflection.

Dimensions: 12½ x 5½ x 8½.

Weight: Approx. 18lbs.

The only hitch is availability. Factory deliveries are long and demand is great.

**YOU DON'T MIND WAITING FOR SOMETHING GOOD — A "KLEMT" IS REALLY WORTH WAITING FOR.  
ORDER NOW AND AVOID DISAPPOINTMENT.**

**FROM THE FIRM THAT VALUE BUILT****P. H. ROTHSCHILD & CO. LTD.**

83 Pretoria Street, Lower Hutt - P.O. Box 170 - Telegrams: "FRANDS"

# LOOKING AT

## Column Loudspeaker Systems

This article discusses the design and likely uses for sound column speaker systems.

First and foremost, it is necessary to define exactly what we mean when referring to a column loudspeaker system.

There are two basic varieties of columns but they have little in common. In fact they are almost diametrically opposed in purpose and operation.

The kind of column with which we are **not** concerned is that currently finding some favour both in this country and overseas for home high fidelity systems.

Prompted largely by an increase in interest in stereo sound reproduction, a need has arisen for loudspeaker units which occupy a minimum of floor space, and yet give good frequency response.

To satisfy this particular need, loudspeaker units have been contrived in which the speaker, usually about 8" in diameter, is mounted pointed upwards in the top of a hollow column, some 3 or 4 feet high, and, of diameter, just sufficient to accommodate the speaker.

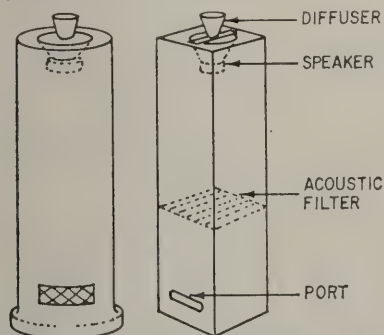


FIG 1. Two types of Column Systems for Domestic Hi-Fi Equipment

These tubular or square columns have been built (as shown in Fig 1) from concrete and earthenware pipes, tubes of thick cardboard, and wooden structures. Most of these designs incorporate some form of vent or port at the lower end, to help radiate the lower frequencies. Other treatment techniques involve lining the interior with padding, or including re-

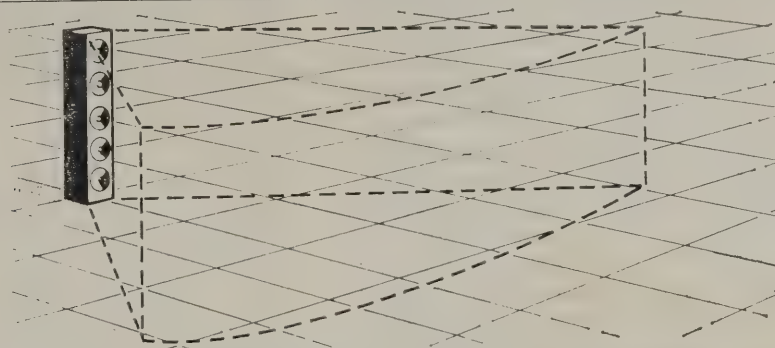


FIG 2. A tall, thin line source concentrates the sound into a wedge-shaped beam with wide horizontal and narrow vertical coverage

flector of acoustic filters to produce correct response and tonal balance.

The type of column we are now going to discuss involves the use of a number of loudspeakers mounted vertically up the face of a tall column-like enclosure.

### Basic Principles of the Column

The basic principle of the column loudspeaker isn't hard to understand. We know that, in general, the larger a sound source, the more directional it is. But, to be technical about it, size is always measured in relation to wavelength. And this of course, means that a reproducer of constant physical size may be very large compared to a short (high frequency) wavelength, while at the same time it is very small compared to a long (low frequency) wavelength.

For example, an ordinary 12-inch cone loudspeaker mounted in a closed box will radiate in all directions at 100 cps, but begins to beam the sound at frequencies about 1000 cps. A 100 cps. wavelength is about eleven feet long—large compared with the speaker cone—while at 1000 cps. the wavelength and the cone diameter are about the same.

Since the ordinary speaker cone is round, its sound distribution pattern is essentially symmetrical. If we had a sound source which was quite narrow, but several feet high (a "line source") distribution in the horizontal plane would

be spread over a wide angle while its vertical distribution would be concentrated in a narrow beam. (See Fig 2).

Suppose that instead of one fairly large speaker, we consider a group of smaller units arranged in a vertical column, as in Fig 3. The horizontal dispersion of such an array is, as we would guess, about the same as that of one of the individual speakers. But the vertical coverage is much narrower, because all the cones move together and the array behaves as a single source. If the column is made up of five 6-inch speakers spaced as close together as pos-

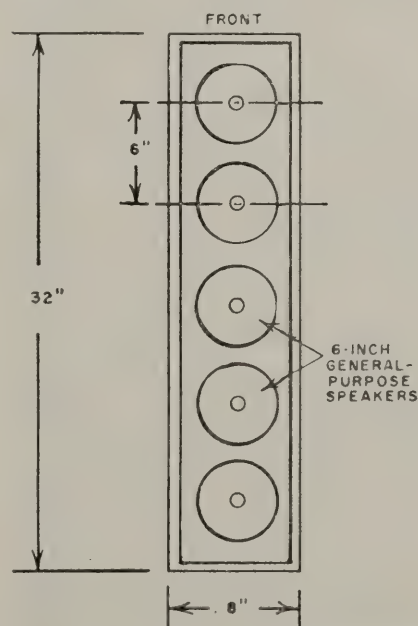


FIG 3. A simple column-loudspeaker configuration. All the speakers are identical and connected together in phase

sible, it will be one wavelength high at about 350 cps., while it is not one wavelength wide until the frequency reaches about 2200 cps. Between these two limits we can therefore expect wide horizontal and narrow vertical sound distribution.

If such a sound column is hung directly over a speaker or performers' microphone, considerable sound amplification can be beamed at the audience without feeding back into the microphone. A single source of amplified sound directly over the live performer is the ideal arrangement for natural-sounding reinforcement; both sources are localised by ear at about the same position, and they are the same distance from the audience so there is no problem of time delay.

There are additional advantages to the sound column. An array of speakers has greater power-handling capacity (and thus greater dynamic range) than a single speaker, even one of somewhat larger cone size. Also the slim shallow configuration of a column makes it easy to conceal.

### Column refinements

We must remember that the line source tends to become increasingly directional at higher and higher frequencies. This means that beam width is not constant—it may become so narrow in the upper voice range that the audience cannot be covered with one or two columns. Also, the fact that the individual loudspeakers in the column are necessarily separated from each other results in interference effects which can degrade both the frequency response and the directional characteristics of the array. Instead of concentrating the sound in a single direction, additional beams of energy are actually produced, as shown in Fig 4.

What is needed is some way to make the height of the column automatically change with frequency, so that its size with regard to wavelength, remains constant. It should be half as high at 2000 cps. as it is at 1000 cps., and so on. In practical terms, the centre speakers should be the only ones

to reproduce the full frequency range; the upper limit of the other speakers must be restricted more and more toward the top and bottom of the column.

This is called "tapering". It can be done by feeding the speakers through electrical filters,

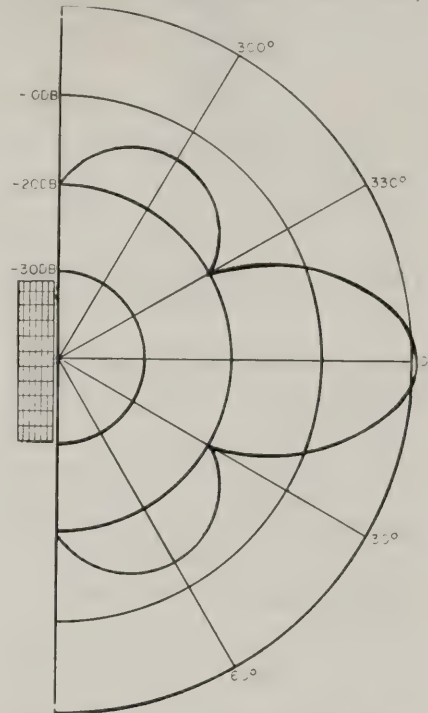


FIG 4. The graph of vertical sound distribution from a simple column at higher frequencies. Notice unwanted lobes appearing

by placing acoustic filters in front of certain speakers, or by using speakers with differing high-frequency limits.

The acoustic filter method of tapering has been suggested, although it is not available commercially. This was described in a paper by David L. Klepper and Douglas W. Steele at the 1962 Annual Audio Engineering Society meeting. As shown in Fig 5 a group of identical speakers is employed, but fibreglass wedges are placed in front of the array. The thicker the wedge, the greater its high-frequency absorption. The result of this increased absorption is a smooth gradation of effective length in proportion to wavelength.

### Other techniques

A further refinement is produced by designing what amounts to two sound columns side by side

—a low frequency column and a high frequency column—fed by a standard 2000 cps. crossover network (Fig 6). Individual groups of speakers in each of the two columns are connected through high-frequency roll-off filters. Thus the frequency range

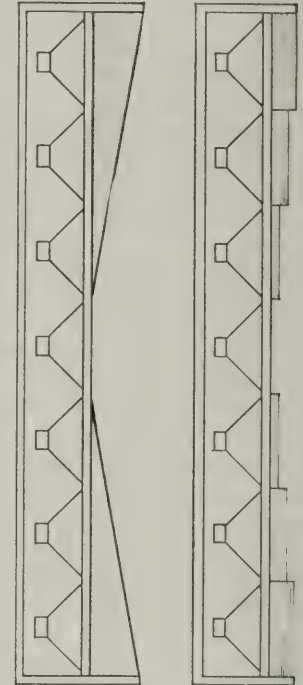


FIG 5. Two methods of tapering the high frequency response at top and bottom of the column. One uses wedges of fibreglass, the other uses blocks of polystyrene foam

handled by the column is broken into two bands, each reproduced by its own in-line array. And each array is electrically tapered to maintain uniform sound distribution.

Straight-line arrays usually have a vertical coverage angle of about 30 degrees. Theoretically this could be made smaller or larger, but when other factors are considered, and practical components employed, this is the way that things work out. Now 30 degrees is satisfactory in many installations, but where speakers must be located quite a distance above the performers, or where the audience area is especially deep, it may be necessary to use several sound columns, tipped at different angles, to give satisfactory coverage.

One American firm makes two sound columns especially designed

to provide a greater vertical coverage angle than the straight-line radiator, yet with directionality still highly controlled. These sound columns are curved-line arrays in which the speakers are mounted in a concave configuration rather than a straight line. The vertical coverage of the curved-line radiator is about 60 degrees, so it can be used in cases where two sound columns would otherwise be needed.

The fact that such a number of variations on the basic sound column are now available tests to the versatility and popularity of these devices. But they inevitably have their limitations and the audio specialist should keep in mind that the sound column is not the ideal loudspeaker for all applications.

For one thing, neither a sound column or anything else will change a reverberant gymnasium into a concert hall. Sound columns, like other directional loudspeakers, tend to minimise reverberation and feedback by beaming sound energy toward the audience, where it is largely absorbed. But there is inevitably some "spill" and if the room is

substantially an echo chamber, bare intelligibility may be the most which can be achieved.

Another point about sound columns is that while the concentration of sound energy into a restricted beam gives an apparent increase in efficiency, the dynamic range of these units is still a long way from that of high-quality horn/driver combinations. Sound columns are most often used for speech reinforcement indoors, so there is usually no difficulty in getting enough intensity.

The third limitation results from the neat, diminutive size of the sound column. We pay for small size in the sacrifice of bass response—most commercial sound columns are designed to work above 100-200 cps. This is fine for speech reinforcement, but if the installation is also supposed to reproduce music then sound columns have their limitations.

As an example of this, one can bring to mind some of the small columns, often employed in hotels and commercial buildings for paging and background music, which have no more to offer in the way of fidelity than a mantel radio receiver.

While extreme fidelity may not be the major object in a public address installation, it is natural to seek the most favourable possible compromise with the conflicting factors of size, cost and possibly portability. But even if we allow for fairly generous ideas in regard to size, bass response is likely to pose a serious problem.

#### Some design problems

A typical column of medium size, such as is described by a well-known Australian and N.Z. Loudspeaker firm in their publication on loudspeaker enclosures uses four of the 9in. x 6in. or 8in. speakers. These are quoted as having cone resonances varying from 90 to 75c/s. Used in an open backed column, these speakers produce quite a smooth response down to the region of these frequencies, with the output dropping off below this.

If, however, the rear of the cabinet is closed in, to reduce

radiation from the rear of the enclosure, then the cone resonances rise quite markedly up to a value of between 125 and 200 cps.

One method of reducing this effect is to use a vent, but have this distributed down the side of the front baffle from top to bottom, in the form of small holes about  $\frac{1}{4}$ in. in diameter. This serves all speakers equally, produces high acoustic resistance and rounds off many of the peaks in the response. The total number of holes required, is dependant on enclosure volume and fundamental resonance of the speakers.

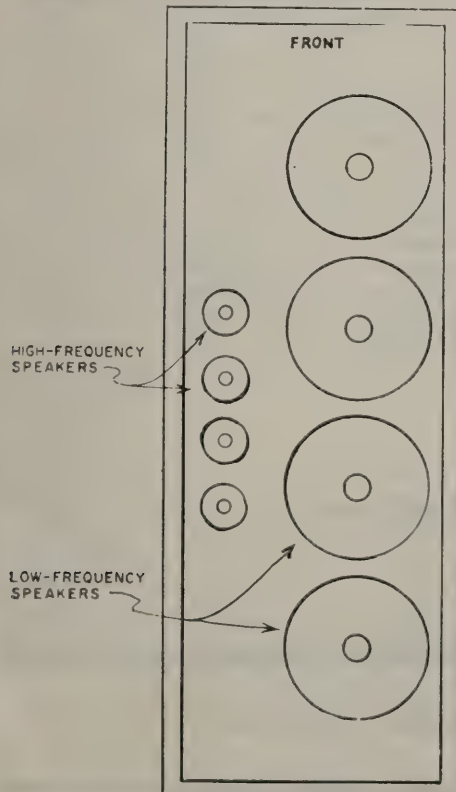
There are two points which should be kept in mind when considering the construction of a column speaker. Generally speaking, designers of loudspeakers prefer all the voice coils of the speakers used in a column to be used in parallel, in order to assure, as far as possible, in-phase operation of the individual speaker cones. In addition the connections should be so phased that the cones all move in the same direction, at the same time.

One problem produced by the connection of a number of speakers with low voice coil impedances, in parallel, is the difficulty of matching to the very low resulting impedance. However, the use of the more modern medium impedance (15 ohm) voice coils eases this problem somewhat, particularly as a standard line to voice coil matching transformer will be utilised with most Public address applications.

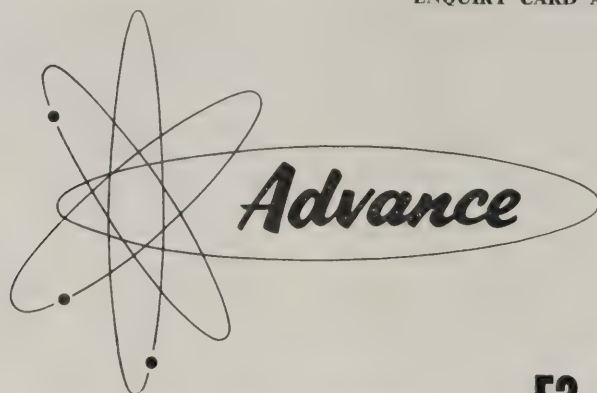
#### References

- "Rola" Loudspeaker data, Technical Bulletin No. 21.
- "Rola" recommended Designs for Loudspeaker Enclosures — "Column Speakers Solve P.A. Problems" by G. A. Briggs, Radio & Electronics, May, '64
- "Column Speaker for Halls and Churches" by N. Williams and J. Davidson, R. TV and Hobbies, July, 1961.
- "Column Loudspeaker Systems" by G. Augspurger, Electronics World, June, 1963.
- "Loudspeakers" by G. A. Briggs.
- "High Fidelity Pocket Book" by W. E. Pannett, A.M.I.E.E.

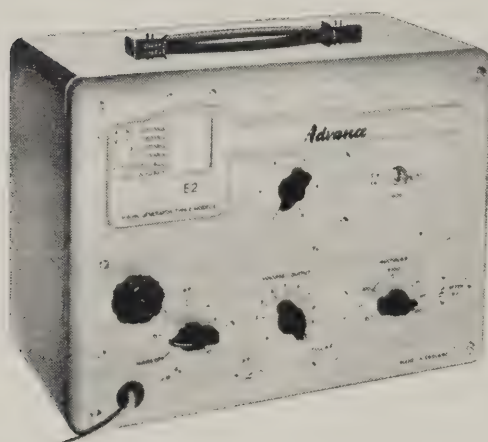
Fig. 6 — Two Sounds Columns



ENQUIRY CARD AD. 9



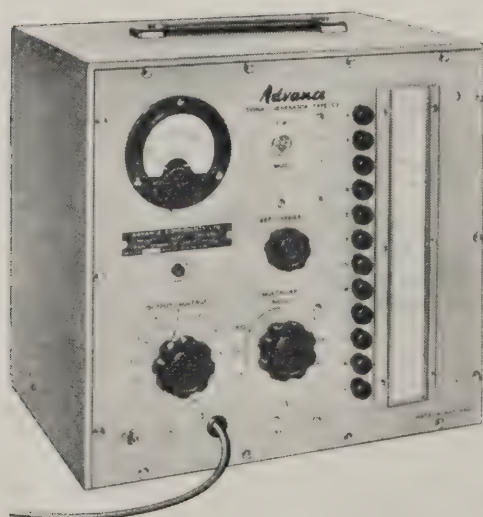
## r.f. signal generators

**E2**

### R.F. Signal Generator

*Frequency range* 100kc/s to 100Mc/s in six bands. *Calibration accuracy*  $\pm 1\%$ . *Output* Approximately 1V at the full R.F. socket. Continuously variable  $1\mu\text{V}$  to 100mV. *Accuracy of maximum output*  $\pm 3\text{dB}$ . *Accuracy of step attenuator*  $\pm (3\text{dB} + 3\mu\text{V})$ . *Output impedance*  $75\Omega$  unterminated. Normally this is matched with a  $75\Omega$  terminating pad TP1B, providing  $37\Omega$ ,  $10\Omega$  and a standard  $10\Omega$  dummy aerial. *Modulation* INTERNAL  $30\% \pm 5\%$  at 400c/s  $\pm 10\%$ . EXTERNAL 0 to 80%, 10c/s to 4kc/s; 0 to 40% at 10kc/s. *A.F. output* 0 to 50V, 400c/s into high impedance. *Leakage* Less than  $3\mu\text{V}$ . *Power requirements* 105 to 125V and 210 to 250V, 40 to 100c/s, 20W.

*Dimensions* 13in (33cm) wide  $\times$   $10\frac{1}{2}$ in (26cm) high  $\times$  8in (20.3cm) deep.  
*Weight*  $17\frac{1}{2}$ lb (8kg).

**C2H**

### R.F. Signal Generator

*Frequency range* Twelve spot frequencies in the range 30kc/s to 40Mc/s. *Output* Continuously variable  $1\mu\text{V}$  to 100mV. *Accuracy* Below 10Mc/s,  $\pm 1\text{dB} \pm 1\mu\text{V}$ ; 10 to 40Mc/s,  $\pm 2\text{dB} \pm 2\mu\text{V}$ . *R.F. level* The R.F. level between push-button settings does not vary by more than  $\pm 3\%$ . With  $\pm 10\%$  a.c. supply variation, the output level change will not exceed  $\pm 3\%$ . *Output impedance*  $75\Omega$  unterminated. *Modulation* Carrier internally amplitude modulated  $30\% \pm 5\%$  at 400c/s  $\pm 5\%$ . *Power requirements* 100, 210, 230, 250V, 40 to 100c/s, 25W. *Dimensions*  $12\frac{1}{2}$ in (31cm) wide  $\times$   $13\frac{1}{2}$ in (33.7cm) high  $\times$  10in (25.4cm) deep. *Weight* 28lb (12.7kg).

**ADVANCE ELECTRONICS LIMITED ENGLAND**

Sole New Zealand Representatives

**TURNBULL & JONES LTD.**

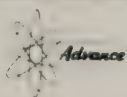
Auckland

Wellington

Christchurch

Dunedin

FROM THE COMPREHENSIVE RANGE OF



INSTRUMENTS AND EQUIPMENT

# Instruments To Test And Monitor Communications Equipment

by J. Stubbs Walker

The development of communication techniques and the ever-increasing demand for wider-bandwidth and higher-quality transmission channels have introduced new requirements for advanced designs of testing and monitoring instruments. Although many of these have been introduced to deal with more-or-less conventional speech and telegraphy circuits, a number of special needs have arisen. These include channels used for the fast-growing data-transmission traffic, the distribution of distortion-free video waveforms and the requirements for high degrees of accuracy in microwave navigation transmitters.

Since the earliest days of radio and cable communications, British manufacturers have been active in devising test equipment: the first railway telegraph machines were, in fact, developed from electrical laboratory instruments.

Today, members of the Scientific Instrument Manufacturers' Association of Great Britain have developed new test equipment which is commanding a significant section of world markets and several manufacturers report that up to 50 per cent of their production goes abroad; one company can claim that more than a third of their instruments are sold to the United States of America.

## Noise Investigation

Noise is the perpetual enemy of the communications engineer. The noise may originate in components used in the equipment or it may be produced by the transmission channel. Sometimes design faults can be blamed. There are several examples of British instruments designed for noise investigation.

A wave analyser, the K-134-A, has been introduced by Muirhead

for tracing and investigating noise and vibration over a frequency range of three c/s to 30kc/s to an accuracy of 0.5 per cent. A feature of the instrument is portability, and it is either mains or battery powered. As well as simplifying the use of the analyser for on-site operation, the battery facility is helpful in making measurements where there are possibilities of earth loop currents being present. The Muirhead instrument also has a facility for varying the bandwidth — 2 per cent, 10 per cent of the in-tune frequency or all-pass.

Marconi Instruments has produced a distortion factor and noise-level meter for measurements of high-quality audio circuits and equipment in the frequency range 20c/s to 20kc/s. The normal bandwidth of the instrument is 100kc/s, but when the spectrum to be examined requires to be restricted, this can be reduced to 20kc/s. Percentage distortion is shown directly on a meter which indicates full-scale values from 0.1 per cent to 100 per cent. Accurate measurement can be made, down to 0.05 per cent distortion.

Another instrument for audio frequency investigations is an alternating current/direct current comparator produced by the Cambridge Instrument Company which measures the value of alternating voltages and currents irrespective of their waveform. This is achieved by feeding the alternating input — at any frequency from 25c/s to 20kc/s — to a vacuo-junction and comparing the resulting output with a known DC source. The vacuo-junction has an AC-to-DC transfer error of less than 0.01 per cent so that values from 0.5V to 300V and five milliamperes to three amperes can

be measured to an accuracy of 0.05 per cent over the whole frequency range.

## "White" Noise

Noise, as such, is an electronic engineer's nightmare, but it is necessary to have instruments that can generate noise in a controlled fashion for tests and comparisons. An instrument that produces "white" noise — noise that is uniformly level over the frequency bands being investigated — has been produced by Dawe Instruments. This covers the satisfactorily wide frequency-range of 10c/s to 5Mc/s in three bands. The lowest of these, 10c/s to 20 kc/s, can be used for various forms of 'acoustic investigations' — assessing the efficiency of loudspeakers, microphones or the properties of studios and acoustic chambers. The two higher bands — 10c/s to 500kc/s and 10c/s to 5Mc/s — are valuable in receiver interference tests and investigating cross-talk on multi-carrier telephony. By using a filter, the noise spectra of semiconductors can be simulated. In the Dawe instrument, the generation of "noise" is achieved by using a thyatron valve in a transverse magnetic field.

Several instruments are now available for the testing of television transmitters and the analysis of video signals. One of these is a sideband analyser developed by Marconi Instruments. This can be used with transmitters working on Bands I, III, IV and V, for 625-, 525- and 405-line standards and either positive or negative modulation. The lower and upper sideband responses are displayed in their correct amplitude and frequency relationship to the carrier, and the instrument — provided in portable or rack-mounted form — can be applied

ENQUIRY CARD AD. 10

# NEW LUCAS PRODUCTS RATINGS PRICES



All the above units feature a new improved projection welded encapsulation complying with VASCA SO-10, whilst retaining the proven reliability of the established ranges which they replace. Where units are specified as replacements, they are electrically interchangeable.

## DD 40 SERIES DIFFUSED SILICON RECTIFIERS

\* Extended Voltage Range up to 1350V. transient P.R.V. \* International standard outline to VASCA SO-10 Jedec DO4. \* 6 Amperes at 100°C stud temperature. \* Immediately available at realistic prices. \* Reverse polarity types available.

## ZD 4000 SERIES DIFFUSED SILICON VOLTAGE REGULATORS

\* 10 Watts total dissipation at 100°C stud temperature. \* Available from 12 to 100 Volts. \* Available with nominal tolerance on voltage of 5% or 10%. \* Reverse polarity types available. \* Commercial equivalents of CV7205 to CV7227 and CV7247 to CV7269. \* Replacements for ZD500 series voltage regulators.

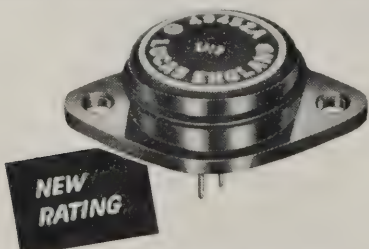
## DD 4520 SERIES DIFFUSED SILICON RECTIFIERS

\* 10 Amps at 150°C stud temperature. \* Can be used to replace all DD51 and DD52 stud mounted rectifiers. \* Reverse polarity types available.



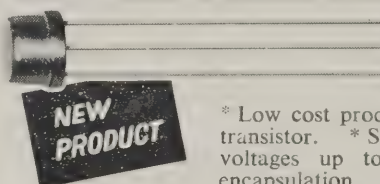
## DT 3200 NPN POWER TRANSISTOR

\* New cold-welded encapsulation for improved reliability at lower cost. \* Gain range 15—45 at 3 amps. \* VCB rating 45 and 80 Volts. \* Silicon performance and reliability at germanium prices. \* Suitable for use in Lf medium power professional applications. \* Economical to use in Industrial and control applications. \* Provided with special mounting clamp for use on heat sinks.



## DT 4100 NPN POWER TRANSISTOR

\* Higher collector currents at lower prices.



## DT 1003 NPN HIGH VOLTAGE DIFFUSED SILICON TRANSISTOR

\* Low cost production version of prototype XTIA transistor. \* Suitable for use in circuits where voltages up to 200V. occur. \* TO5 welded encapsulation.



## DT 4300 NPN HIGH VOLTAGE DIFFUSED SILICON TRANSISTOR

\* Intermediate power High Voltage Transistor. \* Gain 10 — 50 at 3 Amps. \* VCB ratings up to 500V. \* Maximum power dissipation 30 Watts. \* New cold-welded encapsulation with special mounting clamp to TO3 outline for improved reliability and lower cost.



Eight new price reductions. These apply to your large volume requirements — not only small quantities — meaning savings where they really count.

DT. 1500 Series NPN Power Transistors.  
DT. 1600 Series NPN Power Transistors.  
DT. 4100 Series NPN Power Transistors.  
ZD.000 Series Voltage Regulators.  
ZD.2000 Series Voltage Regulators.  
DD.20 Series Rectifiers.  
DD.30 Series Rectifiers.  
DD.71 Series Rectifiers.

Enquiries to:—

JOSEPH LUCAS (N.Z.) LTD.,  
BROADWAY, NEWMARKET,  
AUCKLAND

**LUCAS**  
SEMICONDUCTOR DEVICES

to the testing of most video equipment to be found in a television station.

Test waveforms are produced by the sideband analyser and are fed to the transmitter of the equipment under test. The output signal is then processed and fed to an oscilloscope.

### Distortion Measurement

Standard Telephones and Cables has recently announced a distortion measuring set for determining the phase and amplitude characteristics of television links. The conventional oscilloscope display is replaced by a meter on which phase variations between 0.1 and 15 degrees, and amplitude variations between 0.1 per cent and 5 per cent, can be measured at any desired point along the waveform. The standard test waveform is applied to a band-pass filter which passes only the colour sub-carrier.

Standard Telephones and Cables has concentrated not only on circuit techniques in its new range of instruments but also on a high degree of ruggedness, particularly in transistorised equipment. One of its engineers recently completed a 3600-mile tour of European markets carrying a selection of transistorised instruments in the boot of his car and on the floor beside the driving seat, without any protective packing. During the journey, the instruments were unloaded and reloaded frequently for customer demonstrations and at least twelve times for inspection at customs barriers. Only one piece of equipment temporarily failed to work: after a long trip over badly surfaced roads, a battery had been shaken from its retaining clip!

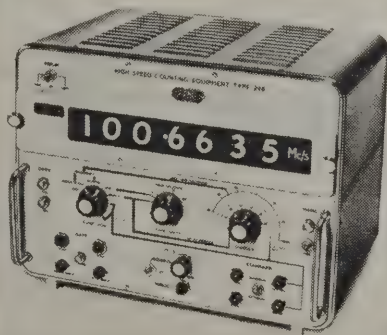
Microwave navigation systems are called upon to operate at high power but with the lowest possible deviation in amplitude or frequency. Spurious modulation needs to be kept to a minimum. James Scott (Electronic Engineering) Ltd. has designed microwave noise measuring equipment which, in standard form, covers the frequency 2.7Gc/s to 18.0Gc/s. The first version of the instrument was designed for Britain's Royal

Radar Establishment and incorporated a novel radio-frequency discriminator developed by the R.R.E. In its engineered form, the instrument is capable of measuring and analysing the fine structure of extremely low-order, spurious modulations in the region close to the carrier frequency. Measurements can now be made only 50c/s from the microwave carrier frequency.

Frequency measurement is of importance in all aspects of communications work — from audio (and sometimes lower) frequencies to microwave frequencies.

### High-Q Wavemeter

From Decca Radar comes a high-Q, direct-reading wavemeter which is available to cover any 12 per cent microwave band from 4Gc/s to 12Gc/s. An electroformed cavity forms the resonator, and a non-contacting plunger and special mode-suppressors keep spurious resonances to a minimum. A spiral scale can be read to an accuracy of 0.25Mc/s. Absolute accuracy is of the order of one part in 5000 and the meter gives full-scale deflection for an input of less than 0.5 milliwatts.



Facilities for measuring strength of carrier, sideband and depth of modulation are provided by the Airmec ultra-high-frequency wattmeter. (Airmec Ltd.)

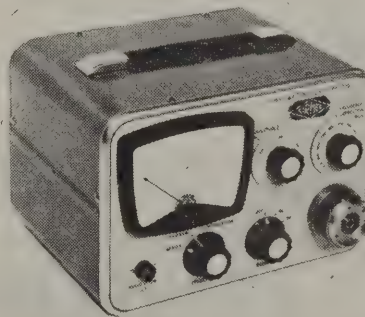
A high-speed frequency counter which, when used with a frequency converter, is capable of presenting measurements up to 500Mc/s on a twelve figure digital display has been put on the market by Airmec. The basic instrument, type-298, measures from DC to 100Mc/s, its digital read-out giving automatic indication of decimal point and units of measurements — cycles, kilocycles and

megacycles. Apart from the instrument's frequency-measuring ability, it can record time intervals from one microsecond to  $10^8$  seconds.

The Airmec counter, which is completely transistorised, incorporates a standard oscillator with an ampere-turn-cut crystal in a temperature-controlled oven which provides a short-term accuracy of five parts in one hundred.

### Ultra-high-frequency Wattmeter

Another interesting Airmec instrument is an ultra-high frequency wattmeter, a compact, portable instrument measuring carrier power, sideband power and modulation depths in the frequency range 1Mc/s to 1000Mc/s.



This Airmec high-speed counting equipment can measure up to 500 megacycles per second when used with a conversion unit. (Airmec Ltd.)

Carrier and sideband power are indicated directly on a meter but for modulation measurement the carrier power is first measured and the meter needle is then brought back to its original reading by the movement of a calibrated potentiometer, when modulation depth is shown on the potentiometer scale.

A form of frequency comparator has been produced by Muirhead which is capable of checking the frequency of an oscillator to crystal accuracy — 0.005 per cent. The principle is to compare the unknown frequency with an internal source, and display the result in the form of a Lissajous figure on a miniature built-in cathode-ray tube. Three crystals can be mounted permanently in the instrument, providing a fre-

Please turn to page 34

ENQUIRY CARD AD. 12  
**RADIO & TELEVISION  
 INTERFERENCE  
 and NOISE  
 SUPPRESSION**  
 OF APPLIANCES  
 AND EQUIPMENT

Mr. Appliance Manufacturer —  
 Mr. Dealer —

We specialize in this field and  
 manufacture a full range of interference  
 suppressor inductors for use both  
 internally and externally on equipment.

Line cord filters are also available  
 in 1, 3 and 6.5 amp.

Write for illustrated booklet

**Inductance Specialists LTD**

Cameron Rd. South, Greerton, Tauranga

## A TRANSISTORISED AUDIO OSCILLATOR

In our June 1964 and July 1964 issues we described a variable frequency power oscillator suitable for testing audio equipment such as speaker installations. Consequent upon our later article dealing with a medium quality transistor power amplifier (R.E. & C. Dec. 1964) we have been asked to provide a circuit for a transistorised oscillator to provide variable audio frequencies for the same purpose. The circuit below is not original, having appeared in a number of Mullard publications. However, it has been checked for operation with a 9 volt supply and the feedback stabilising circuit has been investigated for operation at the low voltage resulting from a flat 9 volt battery, say down to 6 volts.

Whilst the circuit described was produced as an auxiliary for other equipment it appears as if a small audio oscillator in self-contained form has some appeal to con-

structors seeking a simple and relatively cheap source of audio signals.

Various elaborations could be built upon the basic circuit — output monitoring valve voltmeter and attenuator are the two most likely.

The output is approximately .5 volt across 1 K ohms and this is quite suitable for most audio equipment testing.

### The Circuit

The oscillator circuit employs a Wien bridge configuration  $R_A C_A$  and  $R_B C_B$  with feedback amplitude control by means of a thermistor from the output to the OC45 emitter.

A frequency range of from 15c/s to 15kc/s is possible with three ranges and a higher top frequency is possible if  $C_A$  and  $C_B$  are reduced in yet another range step.

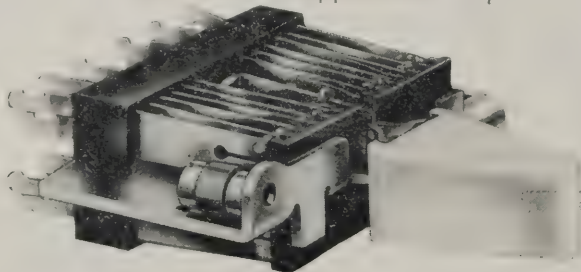
The original published circuit used a thermistor of 5K ohm value

ENQUIRY CARD AD. 11

## A SWITCH AND LAMP UNIT FOR CIRCUIT DESIGNERS



Adopted by the British Post Office, the new miniature lever key is a compact space saving switching device of smart modern appearance. Up to 12 contact springs can be actuated by each throw of the



handle — giving up to 6 make or 4 changeover actions.

Twin silver contacts rated at 300 M/a 100V dc are employed, and the moulded handle is available in several colours.

**Mechanical action:** Lock/Lock Non-lock/Lock  
 Lock/Stop Non-lock/Stop  
 Non-lock/Non-lock

For further information, apply to:—

**Telephone Manufacturing Company (N.Z.) Ltd.**

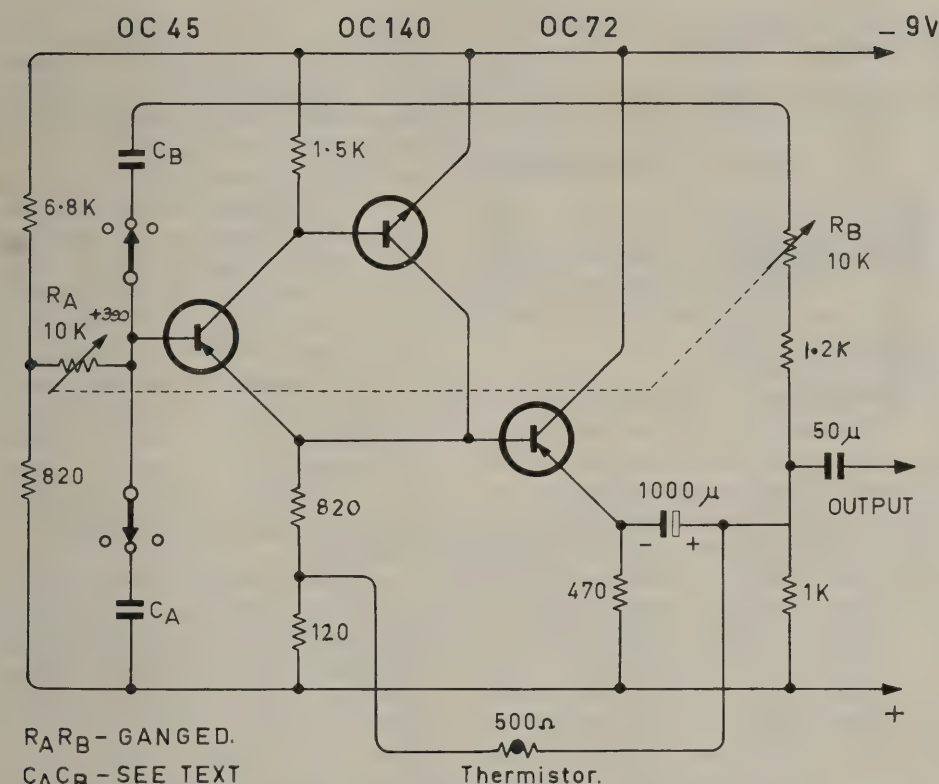
P.O. Box 2763, WELLINGTON

Telephone: 55-020

A MEMBER OF THE



GROUP OF COMPANIES



### SIMPLE WIEN BRIDGE TRANSISTOR AUDIO OSCILLATOR.

but this was found to be too high a value and considerable variation of circuit values indicated a 500 ohm thermistor to be more suitable. The emitter resistors for the OC45 are also matched to the 500 ohm thermistor.

#### Frequency Ranges

With CA and CB each

1 μF	10c/s to 100c/s
.1 μF	100c/s to 1kc/s
.01 μF	1kc/s to 10kc/s

These ranges are, in practice, a little extended at each end and overlap will occur satisfactorily.

Whilst the oscillator has been developed as a cheap and simple unit the performance is good and the use of a mains supply, rather than a battery, is warranted if lower distortion is required.

A worthwhile variation is the use of fixed resistors in place of the ganged potentiometer for RA and RB so that fixed frequency steps can be obtained. The use of high stability resistors would

then produce a very stable oscillator.

#### Construction

No special techniques are required in the layout and our prototype was built on Veroboard printed circuit and was easily accommodated on a piece 4" x 2½". The transistors do not require heat sinks but the 500 ohm thermistor (an ST & C type A 52), being of the glass bead type, should be kept away from direct heat and light. These small thermistors are very sensitive to "spot" heat from, for instance, a workbench lamp or bright sun and should be positioned in the unit in a protected place if a grill or expanded metal type cabinet is used where bright light or spot heat can penetrate. On the other hand, these thermistors correspond correctly to ambient heat changes. To protect against slight light sensitive reaction the thermistor bead should be

shrouded by a piece of black spaghetti.

During construction a 3dB change in output was noticed when the thermistor was in bright sunlight.

#### Components

No special selection of components is needed but in the interests of reliability it is suggested that ¼ watt resistors be used rather than the smaller 1/10th watt. Similarly 250V or 500V capacitors should be used for the frequency capacitors CA and CB.

#### Performance

If battery power is used then the fall of performance with fall of battery voltage is important, see Table 1.

#### Output versus Battery Voltage

relative to 7.5 volts at 1kc/s	
6.3V	-1.0dB
7.5V	0dB
9V	+2dB
15V	+4dB
Time for stability when suddenly switching from 7.5 to 15V is 1½ secs.	

#### Output versus Frequency Change

relative to 7.5 volts battery voltage

- output change over any frequency position — max. to min. .8dB
- output change when switched from one frequency position to adjacent i.e. exact decade change .3dB

#### Output versus Temperature Change

relative to 75°F ambient and

7.5V battery voltage

85°F -2.5dB

65°F +.5dB

55°F +.8dB

The thermistor stabilisation exercises heavier control at the lower temperatures. The laboratory at which the tests were carried out was subject to hot autumn sun throughout the three days of test.

#### General

A 9 volt supply of reasonable stability would mean an oscillator of excellent performance as there is no doubt that operation at 6 volts is the lowest limit for reasonable distortion and output stability. Also the effects of wider ambient temperature variation are less with a 9 volt supply.

Table 1 — Distortion versus Battery Voltage

Frequency	Battery Voltage	7.5V	9.0V
100c/s	4%	1.5%	1.0%
1kc/s	2%	.8%	.4%
10kc/s	1.5%	.7%	.3%

# Training and Recognition of Electronics Technicians

V. M. Stagpoole\*

The tremendous changes that have taken place in the field of electronics in N.Z. since the end of the war are no more apparent than in the field of staffing and training. A few years ago the only formal training in the electronic field was that of what we now call the "professional" electronic engineer. The technician and serviceman and indeed the engineer studying for Institution examinations was largely expected to train himself. It is true that there were several Radio Colleges, but it was not necessary to attend these to gain the necessary legal qualifications, (such as the Certificate of Radio Technology or the Radio Serviceman's examinations), and probably the majority of candidates managed to get through on home study.

The influx of trained men from the armed services after the war staved off the problem for a few years, but eventually this source dried up and it became apparent a decade or so after the war that only the keenest of trainees could absorb all the knowledge necessary to qualify without formal tuition, and many likely lads were falling by the way simply because of the lack of teaching.

The gradual depletion of the ranks of trained technicians, the poor rate of qualification, and the accelerating demand for technicians has forced the authorities to set up their own training schemes for all types of technicians, which culminates in several types of certificate. Of these the newly created Radio Technicians Certificate and the slightly older N.Z. Certificate in Engineering (Electronics) are the two which interest the electronics technician.

Both these examinations require a lot of formal study; in fact, to get an NZCE takes about the same amount of study and time as a B.Sc. degree. It might be expected

therefore that the NZCE would receive about the same recognition as an ordinary bachelors degree, but regrettably such is by no means the case.

## Recognition for Training

Recognition is certainly a very thorny problem. It would perhaps be not unreasonable to expect that gaining a qualification like NZCE would place the possessor into a higher salary category, such is not the case. A technician who spends years getting his NZCE will almost certainly be in a lower salary bracket than his schoolmate who became a clerk. In fact in the government service anyway, if he wants to proceed much above the £1500 a year level he will have to become an "Administrator". No one would disagree that a non-technical co-ordinator is essential, but no one ever bothers to explain why he has to be paid more than the technical specialist. The result of this policy of paying more for paper pilots than for engineering skills, ends up in having some very good engineers trying to get by as very poor administrators.

This does not mean that some engineers do not make good administrators, but it is absurd to have an extremely brilliant and original engineer on clerical work, a job he probably hates but has to take because of the salary increase. It would seem to be much more reasonable to keep a man employed where he is best suited, paying him what he is worth instead of tying him to a system of a priority value judgements which simply do not have a logical basis.

## Engineering Divisions

The growth of the electronics field has meant that one engineer is no longer competent to carry through every aspect of a job. Indeed we can identify quite a few separate engineering grades.

(a) Professional Engineers. The

professional engineer is concerned mainly with the aspects of circuit design (mainly among the younger men), and the formulation of overall systems and techniques, and large scale planning.

(b) Technician Engineers. The technician engineer is concerned with specific aspects of the field. He will perhaps be experienced at the installation and erection of equipment, or he may specialize in a particular type of equipment or some aspect of a system such as maintenance. In his own specialist field he can of course be more expert than the more broadly trained professional engineer.

(c) Technicians. Technicians are by far the largest group in engineering, and they are usually concerned with the equipment as it is used and it is their task to interpret the equipment to the user, and to ensure that it functions correctly and pinpoint and correct its deficiencies.

(d) Servicemen. The serviceman is mainly concerned with what is nowadays called "consumer goods". He is thus the link between the industry and the public.

In the past both the professional engineer and the serviceman have enjoyed a clear cut recognition system. The system consists of

- (a) A qualifying examination;
- (b) Registration;
- (c) An organisation which looks after his interests (not for professional engineers in N.Z.)

For the engineer there has been his graduate exam., registration under the Engineers Registration Act (1924) and membership of the N.Z. Institution of Engineers. For the tradesman there has been the trade exam., registration as a Radio Serviceman, and the appropriate trade union. For the technician until recently there has been neither a universally recognised exam., no registration, and no organisation!

This has now been changed, there is the NZCE and the recently established Engineering Associates Registration Act. Registration as an Engineering Associate,

Please turn to page 37

\* Newlands, Wellington

# Circuit and Service Data

## Bell Tv. Receiver 203

**Installation procedure and present control adjustment:** For optimum results from the Bell Television receiver the following method of installation should be strictly adhered to. A suitable aerial for the given locality is essential if a noise and interference free picture is to be obtained. Field strength readings are available from the local Radio Inspectors Office if you are unfamiliar with the signal in a new area. Overload of the receiver should not be a problem as the Bell Television receiver is capable of handling signals of well over 10mV. Under very favourable conditions it may be possible to use an indoor aerial of some type. If you are unfamiliar with the installation of television aerials a reputable aerial installation firm should be consulted.

**Receiver preset control adjustments:** The Bell Television receiver has been adjusted for optimum operation before leaving the factory, but if any adjustments are required the following procedure should be carried out on a test pattern. Never try to adjust a television receiver on anything but a test pattern.

**Centring the picture:** The picture may be centred on the screen by means of two flat magnetic plates directly behind the deflection yoke. One plate is used to shift the picture up or down and the other to shift the picture to left or right. If the picture is tilted to either left or right, this may be corrected by loosening the two brass screws on the clamp at the back of the deflection yoke, rotating the yoke slightly to correct the tilt and retightening the screws.

**Horizontal linearity:** Horizontal linearity is adjusted by means of the line linearity coil L. 5. Loosen the moulded hexagon screw and move the wire ring in or out until correct linearity is obtained, then tighten the hexagon screw. Greatest change in linearity will be made to the left hand side of the test pattern.

**Vertical linearity and height controls:** Any adjustment to these controls must be carried out on a test pattern. With the linearity controls correctly set, the height should be set so that the top and bottom of the picture is just outside the edge of the mask.

**Line amplitude and boost control adjustment:** Having completed the vertical linearity and height adjustment the

NOTE: See service manual for set-up procedure of phase discriminator line oscillator.

boost control may be adjusted for the correct aspect ratio. It is then necessary to ensure that the boost voltage has not increased in excess of 850 volts (measured with a VTVM) when the brightness is set at minimum and the contrast at maximum. The mains voltage during this check should be 230 volts.

**Line oscillator and phase discriminator:** With signal applied, (a) Short grid of reactance valve (V202b) point H to earth; adjust slug of line oscillator for zero slip. (b) Remove this short, then short to earth the junction of C. 210, C. 209, and R. 212 point G. Adjust phase discriminator balance control for zero slip.

**Channel selector and fine tuning:** The channel selector should be set to the required channel and then the fine tuning control should be pushed in and rotated in an anticlockwise direction until the picture starts to "break up". Clockwise rotation until the "break up" room listening level.

**Tone control:** Rotate until the preferred frequency response is obtained. Anticlockwise rotation reduces the high frequency response.

**Brightness and contrast controls:** Turn both "brilliance and contrast" controls fully anticlockwise. Now turn the Brilliance control clockwise until the blacks of the transmitted picture show really black. Next turn the "contrast" control clockwise until the whites of the transmitted picture show really white. With minor adjustments to suit your individual tastes this is now the best setting.

**Vertical hold control:** Set this control so that the picture rolls slowly downwards. Now reverse the rotation of the control until the picture moves up then locks. This is the correct position for best interlace and lock of the picture.

**Servicing printed boards:** When soldering, solder no thicker than 18 S.W.G. should be used, and in no circumstances should separate acid or greasy fluxes be applied. Avoid excessive heat and solder on joints, overheating can cause the copper laminate to lift. If necessary flux residue can be removed with methylated spirit. When replacing peaking coils, care should be taken in bending the leads, as it is possible to break the thin litz wire.

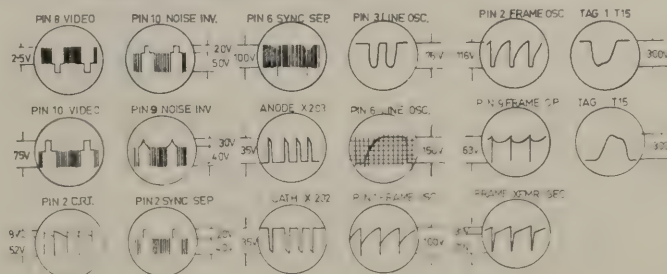
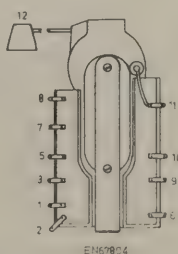
VOLTAGES MEASURED UNDER NO SIGNAL CONDITIONS

VALVE & USE	1	2	3	4	5	6	7	8	9	10
AW9-16W CRT	250	0.5	375	230				105		
10Y6 EXT RECT	265				150	0.5	250	210		
12X6ES LINE O.P.									230	
10AE2 BOOST OSC										125-395
10CE201 W-IF NOISE	37	18	0		55	2	87.3	185	90	145 -5
10CE202 W-IF AGC	138	1.9	0		187.3	79.3	178	150	-2	90
10FL200 VID-SND	0		80	55	65	6	79.3	0	131	110
10P-36 SOUND Q.R.	0	185	184	445	18	233	45	0	92	
10BAR 500PULSE	30	12	87	18	9	152	1.5	31	22	
10CF802 LINE OSC	190	2.0	182		9	190	2	35	0	
10PL85 FRAME OSC	75	16		18	355	225	205	16	0	

CAUTION

SEE NOTE

R/N	VDR TYPE	NO	COLOUR
R201	E198D	A759	GREEN
R22		ZZ06	BLACK & BLUE
R3		FD1A265	WHITE
R202			





The schematic diagram illustrates the internal circuitry of a television receiver, organized into several functional sections:

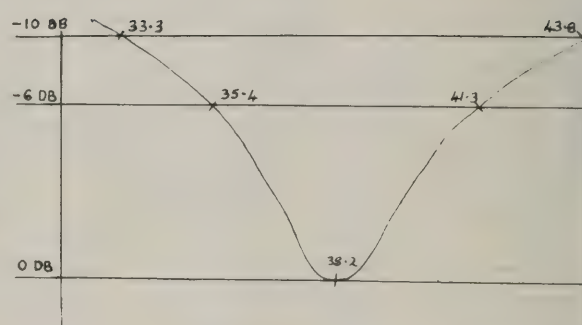
- Video Section:** Features vacuum tubes V101B (PC(F)201), V102B (PC(F)200), V103A (P(F)L200), and V104A (PC(L)86). It includes a video input stage, a video amplifier, and a video output stage. A "VIDEO" input is shown at the bottom.
- Audio Section:** Includes vacuum tubes V202A (PC(L)85) and V203A (PC(L)85). It shows an audio amplifier stage and a speaker output stage. A "CONTRAST" control is also present.
- Deflection Section:** Features vacuum tubes V203T6, V203T8, V203T9, and V203T10. It includes a horizontal sync generator, a vertical sync generator, and a deflection yoke driver. A "HORIZ. LINEARITY" control is shown.
- Power Section:** Includes a 17.5KV EHT (Electron Ray Tube) and a 10x3G speaker. It shows a power transformer and a 17.5KV EHT.
- Other Components:** The diagram includes numerous resistors, capacitors, and transformers. A "BOOST" input is shown at the bottom. A "NEG - REFERENCE PULSE" input is also present.

**HANDLING transformerless chassis:** Always check phasing of power outlet and chassis before proceeding with repairs to a transformerless chassis or use an isolation transformer. Power points have been found incorrectly terminated on occasions and the above precautions should be taken on all occasions.

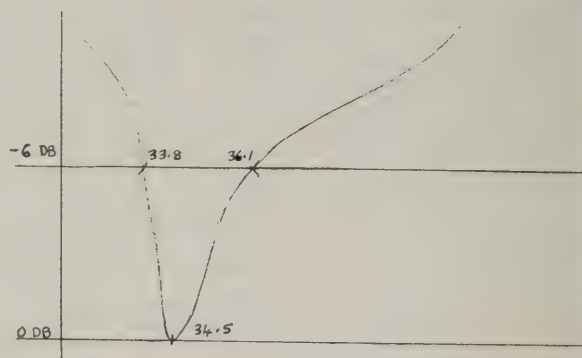
## Alignment Instructions: Vision I.F.

Instruments required—Pattern Generator; Isolation Transformers 1.1; Standard Attenuator; Oscilloscope; Marka Sweep Generator; Bias Supply; VTVM.

- 1—Connect oscilloscope to grid circuit of video amp (tp junction).
- 2—Marka sweep to grid PCF200 (tp).
- 3—Bias to A.G.C. line voltage—6VDC.
- 4—Adjust Video Detector stage (203/T6) to response curve No. 1 as shown.
- 5—Move sweep input to Tuner input and couple sweep generator in through 3 pf capacitor
  - (a) 40.4mc/s trap coil (203/T2)
  - (b) 33.4mc/s trap coil (203/T3)
  - (c) 31.9mc/s trap coil (203/T1).
- 6—Repeat (a), (b), (c) until traps correctly placed as indicated in curve No. 2.
- 7—Adjust tuner I.F. slug for correct position of 38.9mc/s marker, curve.
- 8—Adjust I.F. trans (203/T5) for correct position of 35mc/s marker curve No. 3.
- 9—Adjust I.F. input coil for minimum tilt. Curve No. 3.
- 10—Repeat steps 5 - 10 as required until no further improvement.
- 11—Remove sweep input bias and CRO leads and inject known standard signal from standard attenuator.
- 12—Check performance of receiver on signals for gain etc. This completes the vision I.F. alignment.



Curve 1  
(Grid PCF 200)

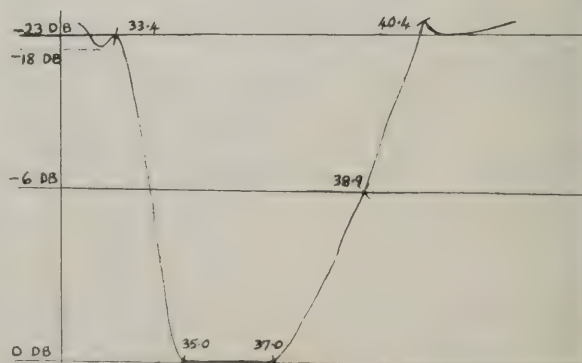


Curve 2  
(Grid PCF 201)

## Test Procedure, Sound Alignment

Pattern generator; Isolation transformer 1.1; Standard attenuator; Output meter; VTVM.

- 1—Connect standard attenuator to antenna terminals.
- 2—Switch to channel with modulated test audio signal.
- 3—Connect VTVM across C119 (4 mfd stabilizing capacitor) test point by Radio detector.
- 4—Inject sufficient signal from pattern generator to operate VTVM and adjust:
  - (a) Sound detector primary (203/T9)
  - (b) Sound I.F. coil (203/T8)
  - (c) Sound trap coil (203/T7) for maximum voltage.
- 5—Repeat (a), (b), (c) until no further change. Check setting of (c) on picture tube for correct adjustment.
- 6—Read voltage obtained. Remove VTVM from C119 and connect to test point at C120 and adjust sound detector secondary (203/T10) for 50% voltage.
- 7—Set standard attenuator to give 14mV, i.e. —29dB (reference 400mV = 0dB into 75 ohms deviation 15kc/s. Voltage across C119 to read 10 volts. Input to audio amplifier 4mV for an output of 1 watt into 3.5 ohms  $\pm 3$ dB with volume control in maximum position, tone control in high position and VTVM removed.
- 8—Switch to sound modulated channel and check quality of reproduction.
- 9—Switch to high level signal and check operation of A.G.C.
- 10—Check operation of all channels.



Curve 3  
Composite overall response curve

# SERVICEMAN'S COLUMN

*Conducted by J. Whitley Stokes*

What do you do when someone brings in a butchered article for service? Do you turn it down flat or do you weaken and decide to have a look at it? I know many servicemen adopt a firm policy of refusing to handle such jobs and yet I can't help wondering whether that is not sometimes being a little too hard on the customer. In saying this I am as well aware as anyone just what stinkers these jobs can be, but even so I try to judge each case on its merits.

Very few owners will openly admit to having had a go at it themselves; sometimes a junior member of the family or a well meaning friend is credited with being responsible for the wreckage. A recent case comes to mind. The owner, or rather the father of the owner, brought in a record player complete with a bag of screws which, he stated had been worked on by his daughter's boyfriend. Perhaps he is an ex boy friend now! Anyway as the father was an old customer and I had worked on the record player once previously I said I would see if anything could be done.

Record changers are often sticky enough jobs without being made more difficult by having many and various unnecessary screws removed with consequent loss of critical adjustments. So I frankly didn't relish the job over much as in such cases the original trouble may become obscured particularly if it was of an intermittent nature in the first place. Fortunately the particular changer was one that I'd had considerable experience with so I wasn't exactly starting from scratch. A close examination of the bag of screws revealed that most of them were from the cabinet and motor board rather than the actual record changer. Practically all this cabinet hardware had been removed unnecessarily — handle 4 screws, lid fastenings 4 screws, changer mountings 6 nuts and 6 springs. All this had been done because the person responsible

had not known that it was necessary only to remove six wood-screws in order to lift out the motor-board and changer in one unit.

After sorting out the wheat from the chaff I found that there were only two nuts and one spring which had been removed from the changer itself. This gave some encouragement to proceed further and after about an hours work I was able to get everything ship-shape again. After this it was left running on a stack of 45's as a soak test, this test being repeated at intervals to make sure no fault had been overlooked. The outcome — a satisfied customer plus a highly profitable job.

Sometime later I was talking shop with a local watchmaker and this same subject of what to do about articles brought in for repair which have previously been tinkered with by the owner, came up. My watchmaker friend was quite definite, his policy is to refuse to handle any such jobs regardless of the circumstances! His reason? He considers that if the owner has "had a go" at it once he may easily do so again **after** it has been put right in my friend's shop. This he believes would lead to too many arguments later. It is a fact too that certain types of owners are born tinkers and will even fiddle about with a thing when there is nothing the matter with it. By the way, I wonder what ever happened to that joker who used to go around with a screwdriver tightening up all the screws on his radio. I haven't come across him for years.

We seem to have run into a spot of bother with funny valves again. Last time it was EF 41's, this time it is EL 36's. A few of these TV line output valves have been found not to function in certain receivers. It is not a matter of marginal operating conditions or anything like that, as the particular valves will not function at all. The effect being no measurable drive voltage at the grid and consequently an inoperative line output stage with all that goes with it.

I conducted an investigation into the matter and found that in all cases the valves appeared to have a grid to cathode short **when in the receiver** but not when removed from it. Most receivers have a grid stopper resistor of around a 1000 ohms or so connected directly at the socket from the grid pin No. 5 to the adjacent blank lug (No. 6) on the socket. According to all valve manuals I have referred to pin No. 6 is marked "N.P.", meaning no pin on the valve, i.e. there are only 7 pins on the octal base. Under the circumstances no TV manufacturer can be blamed for using pin 6 of the socket as a tie point. All the "faulty" valves examined, had a pin in No. 6 position and furthermore this pin was internally connected to the cathode — see sketch.

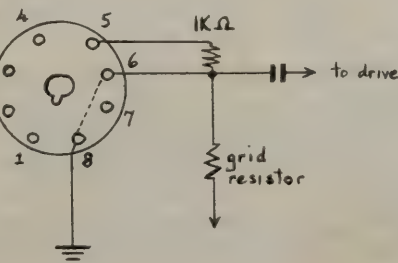
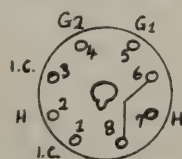
This resulted in the grid being effectively earthed via the 1K grid stopper plus a dead short on the drive voltage applied via No. 6 lug.

It is possible to utilise such "rogue" valves by lifting the wiring from No. 6 lug on the socket and leaving this lug floating — but who wants to be messing around doing this. Another way

**Continued overleaf**

**Left: Connections on base of "faulty" valve showing internal link joining pins 6 and 8.**

**Right: Socket wiring in receiver.**



# LISTENING POST

by michael lawrence

Recently, I seem to have acquired an untidy pile of notes on the various shortwave stations around the world — some of them make sense and some of them don't. So, this month, I will sort out the more useful ones and the rest can be dispatched to the W.P.B.

Remember, that all times are GMT (N.Z. time minus 12 hours) and frequencies are in kilocycles.

**SWEDEN.** Radio Sweden broadcasts half hour programmes in English as follows:— To North America 0145 on 5990. To North America 0315 on 9705. To Europe 1100 on 9620. To Far East 1230 on 11,810 and 15,440. To North America 1400 on 15,240. To South Asia 1445 on 15,440 and 9765. To Middle East 1615 on 15,240 and 11,705. To Africa 1945 on 11,705. To Europe 2200 on 6065.

The DX programme "Sweden Calling DXers" is broadcast every Tuesday in the last part of the transmission.

**POLAND.** Radio Warsaw has been heard at fair strength on 9675 at 0730 GMT. Their announced frequencies for the 0730 and 0830 transmissions in English are 9675, 11,840 and 15,120kc/s.

**INDIA.** It would appear that All India Radio at Delhi intends to replace 15,165 with 9740 in the New Zealand transmission from 1000-1100 as from 2nd May.

**MALAYSIA.** Radio Malaysia puts in a strong signal at 0730 on 11,900 in the transmission to South East Asia, but it suffers some interference from adjacent channels. Other announced frequencies for this half hour English broadcast were checked but could not be heard. These are 9750, 6175, 6105 and 7110 kc/s. These frequencies are also in use for the 2400 GMT English broadcast to South East Asia, and again 11,900 provided good reception, but the others could not be heard. Ten minutes of news is broadcast at the beginning of each transmission.

**STH. KOREA.** The Voice of Free Korea has been operating half hour test transmissions in Vietnamese, French and English in preparation for the new broadcasting services for the members of the Korean military contingent serving in Vietnam. Times and frequencies for these transmissions are:— 1430 on 9640; 2300 on 11,925; 2400 on 15,125; 1530 on 11,925.

The 1430 transmission was of fair quality until 1435 when it became unusable because of severe interference from Deutsche Welle which comes on at this time on the same frequency.

**ETHIOPIA.** ETLF, Radio Voice of the Gospel, at Addis Ababa broadcasts in Malagasy to Madagascar from 1500 GMT on 9540. This transmission has been heard in Wellington at a reasonable strength. Announcements at the beginning of the programme are given in several languages including English.

**YUGOSLAVIA.** Another broadcast for the night owl to listen to is Radio Belgrade's English Broadcast from 1530-1600 on 15,235, 11,735 and 9505kc/s. The 15,235 outlet provides the best reception.

**VATICAN STATE.** Very good reception is provided by Vatican Radio in their broadcast to Australia and N.Z. between 2200 and 2230 GMT on 9630 and 7250kc/s.

**U.S.A.** The latest schedule of Radio New York Worldwide, better known as WRUL, is as follows:— 1615,2000, 17,840; 1500-2200, 17,730; 1200-2400, 15,440; 1245-1600, 15,220; 2015-2145, 11,875; 2200-2400, 11,855; 2100-2400, 9525.

**U.S.S.R.** One of the least publicised stations in shortwave articles is Radio Moscow. The few bits of current information I have on this station are given here.

During our afternoon, Radio Moscow broadcasts in English to North America on frequencies of 9660, 9620, 9570, 7310, 7200, 7150 and 6070. Three of the frequencies 9570, 7200 and 6070 go off the air at 0230 and the remainder carry on after that time. 0700-0730 is the time for the Great Britain and Ireland transmission on 9590, 7280, 7240 and 5980 kc/s. All these frequencies are well heard in New Zealand. Finally, at 0900 GMT Radio Moscow has been heard on 15,360 in English.

**DENMARK.** Contrary to information that the Voice of Denmark was replacing 15,165 with 9520 in the Australia and N.Z. transmission on Tuesday, Thursday and Saturday, it turns out that they are still using the old frequency. However, 9520 is again scheduled to be used from 2nd May so it remains to be seen when the change actually takes place.

**NEW ZEALAND.** The full Radio New Zealand schedule from 2nd May is:—To the Pacific: 1700-1945, 6080 and 9540; 2000-0545, 11,780; 0600-0845, 6080 and 9540. To Australia: 2000-2230, 9540; 2245-0545, 15,110; 0900-1145, 6080 and 9540. To Antarctica (Sundays: 0215-0245, 9540; 0815-0845, 6080.

**UNITED NATIONS.** United Nations Radio now broadcasts to N.Z. only on Saturdays at 0730 on 9665 and 6185. This broadcast is repeated from Honolulu at 0845 on 11,845kc/s.

## Radio Australia Completes its Quarter Century

Radio Australia — the external HF broadcasting service of Australia — celebrates 25 years of operation. Today transmissions from Shepparton are beamed to all parts of the world, and the transmitting complex there is believed to be the most powerful station in the Southern Hemisphere.

Shepparton, 120 miles north of Melbourne, has seven HF transmitters, of which four are 100kW, two 50kW and one 10kW. The 36 aerials are supported on 14 steel towers each 210 feet high.

The transmitting station, designed and built by the Australian Post Office, represents a capital investment of roughly £A1½ mil-

lion. Currently, three 250kW booster transmitters are being built in Northern Australia, near Darwin, to provide better service to SE Asia, Pakistan, India and Ceylon.

Radio Australia took over the 2kW transmitters at Lyndhurst, Victoria, in December, 1939. Lyndhurst had been transmitting programmes since 1934.

Early in the war, it was decided in view of possible enemy damage to the world-wide BBC HF service, that an alternative high-power station should be established within the British Commonwealth.

By the end of the war, two 100kW and one 50kW transmitters had been installed on the 600 acre site at Shepparton in a windowless blast-proof building which is still used as technical headquarters. For emergency use, some 2,000 gallons of diesel fuel are stored at the station, sufficient to keep Radio Australia running for a fortnight.

## Serviceman's Column

Continued from page 23

is to clip off the surplus pin on any such valves before use. A word of warning here though, this has to be done carefully as EL 36 valves have a button-base seal not a "pinch" and the heavy internal wires come straight through into the hollow base pins. Care must be used not to exert any lateral pressure when cutting off the pin as the resultant strain could easily be sufficient to "spring a leak". A third and probably best method is to return any such rogues to the distributor.

+ + +

Did you hear this one? It seems a certain organisation had applied for a licence to import a 100 hp electric motor and included in the specifications were the words "50 cycles". In due course a reply was received stating that a licence would be issued for the motor but not for the 50 cycles as these were now made in New Zealand!

ENQUIRY CARD AD. 13

## "THE J.W.S. FLYBACK CHECKER"



The J.W.S. Flyback Checker is manufactured from an instrument originally devised by TV Serviceman J. Whitley Stokes to give a satisfactory means of diagnosing faulty line output transformers.

The following features are obtained with this instrument:—

- ★ Completely eliminates the need for time wasting substitution testing of suspect flyback transformers.
- ★ Indicates as little as one shorted turn with absolute certainty.
- ★ Tests all makes of line output transformers for shorted turns or continuity.
- ★ Tests made without disturbing chassis wiring.
- ★ Can be used by semi-skilled personnel.
- ★ Devised by practising TV Serviceman who knows servicing.
- ★ Very low price of instrument can be recovered by first few service jobs.
- ★ The only instrument of its type available.

NOTE. Many users have found this instrument handy for checking shorted turns in audio output and frame output transformers.

MANUFACTURERS & DISTRIBUTORS

# REDFERN RADIO

113 Great North Road, Glen Eden, Auckland



One of the many problems associated with communication between base station and vehicles, or vehicle to vehicle, is the presence of noise produced by the many electrical devices in the user's car and other nearby vehicles. One of the worst offenders in this respect is the ignition system, which is prone to produce pulses of short length, but high peak energy. The effects of these pulses are detectable over a large part of the radio spectrum.

One of the first articles written on the subject of suppressing the annoying effects of these pulses at a receiving installation was written by J. J. Lamb in 1936. This article, entitled "A Noise-Silencing I.F. Circuit for Superhet Receivers" appeared in the *Journal Q.S.T.* His system utilised the noise pulses from the receiver at a low selectivity point, amplified and rectified them, and applied the resulting D.C. as bias on a gate tube connected prior to the main I.F. system of the receiver.

Since that time, reference to a large number of technical journals has brought to light the fact that there has only been limited development in this field.

The effects of vehicle ignition noise and other types of impulse noise produced by the large range of modern electrical systems, are most obvious in equipment utilising the amplitude modulation system, whereas those using frequency modulation systems are not so widely affected. Another problem is that the radiated effects of the impulse type interference are most prominent in the region of the radio spectrum between 20 and 200 megacycles, peaking to a maximum in the region of 30 to 70 megacycles. These frequencies are being increasingly utilised for all types of communication services, particularly for mobile radio-telephone systems where usage is increasing at a very fast rate in all parts of the world.

Until recently, one of the simplest, and therefore the most common systems for reducing the annoying effects of vehicular impulse noise was a series, or shunt

# A transistor series gate noise limiter

by Irving Spackman

A.M.I.E.E.E.

diode, or combination of both, connected in series or shunt, or both, with the audio line between the detector and the audio amplifying system. The diode system is interconnected to the diode detector so that it is normally self-adjusting to the average signal level being received and served to open or short the connection to the following audio system during the period of the noise pulse. This did not unduly interfere with intelligence reproduced through the system, providing the length of the pulse was not excessive. However these systems do have some disadvantages. One of these is the inherent loss of audio voltage across the limiter circuitry, together with a tendency to introduce considerable audio distortion at high audio modulation levels.

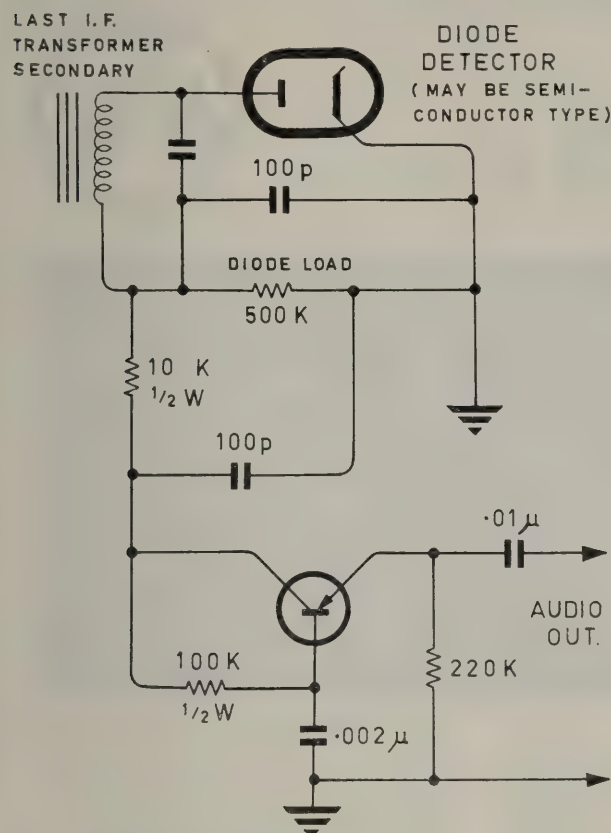
Impulse noise pulses generally have the characteristic that they have high peak energy, but have low average energy because of their short duration. When these pulses are passed through a re-

ceiver with a narrow bandwidth I.F. section (a receiver with good adjacent channel selectivity) these pulses however are lengthened in time, and the sharp peaks are rounded off. In these cases, the series or shunt diode type limiters are not particularly successful.

Unfortunately with the increasing demands being made for communication space, there is the necessity to narrow down the pass-band accordingly. This has brought back the emphasis on the need to control the noise gating section from closer to the low selectivity part of the receiver where the true character of the noise pulses is preserved.

One approach is to place shunt limiting at each stage throughout the I.F. system using what is called "Low Level I.F. Diode Limiters" at the low signal level points, and "Floating-Bias I.F. Diode Limiters" at points where higher signal level exists.

Two recent approaches have been published which both bring the noise gating system to a point



NOISE LIMITER CIRCUIT.

immediately preceding the high selectivity parts of the receiver. One of these developed by the Collins Radio Co. in the U.S.A. is called the Collins Noise Blanker. This utilises a gate inserted in front of the main I.F. chain, but the gating pulses are derived from a separate receiver, tuned to pick up the noise pulses in the region where they are most obvious—namely 40 megacycles. It is claimed that these types of blankets are very effective against certain types of impulse noise, particularly ignition, but less effective against those types of noise which have little spectral energy at 40 megacycles.

The second method, described recently by W. Squires in October 1963 Issue of Q.S.T. approaches the system in a similar manner to the original "Lamb" silencer, but takes the signals for processing and gating from a very low selectivity part of the receiver (the 5.0 megacycle 1st I.F. chain). The gate uses a special type of

transistor, the 2N1169 bi-directional n-p-n switch. When this gate is pulsed, the transistor virtually short circuits the input and output; when pulsed again it provides virtually an open circuit between input and output.

Whilst keeping in mind all these approaches, the author was recently carrying out some work on mobile receivers being used in the 4 to 150 megacycle region of the radio spectrum. The selectivity of the various I.F. strips was of the order of 6 to 10kc wide at the 6 dB point. Observation of the noise impulses on a high speed oscilloscope showed that a different approach to the limiting idea at the diode detector could be considered. When one considers that the maximum audio frequency response required from the receiver, is 3 to 4 kc, then if a gating system is included which passes all frequencies up to this figure but progressively eliminated all frequencies beyond this, noise pulses of short or longer duration

would be rejected providing their pulse length did not approach the same time-constant condition as the gate.

The basic circuit is shown in the accompanying diagram. The transistor type chosen must have a low saturation voltage between collector and emitter, fast turn-on; turn-off ability, and preferably also cheapness. The R.C.A. type 2N404 suits admirably as it was developed as a medium speed switching transistor.

The time constant in the R-C circuit connected to the base of the transistor determines how fast the emitter can rise or fall, and therefore follows the collector circuit. The values shown do not introduce much loss at 3-4kc/s. However when the noise pulses at the collector and emitter are observed on a suitable oscilloscope (a Tektronix type 551 was used by the author) there was a very marked reduction in pulse amplitude at the emitter. In one direction there was virtually nothing, but in the opposite direction a small "stump" about 1/100th of the total pulse amplitude was evident. This appeared to be caused by capacitive feed-through in the transistor.

There is very little loss of audio across the gate, and no signs of distortion on high modulation levels. The system is also suitable for use with both low impedance (transistor) and high impedance (vacuum tube) type receivers.

When used in a high sensitivity mobile receiver in a vehicle passing through the dense traffic in Auckland, the only sign of the fact that the limiter is working is that the overall noise level increases due to increases in average external noise level. Very few cases of impulse noise have been detected, breaking through the gate.

### Further developments

The author is currently working on a system to utilise the noise gating transistor additionally as the gate in a "squench" circuit. Present indications are that the germanium switching transistor must be replaced by one of similar characteristics using silicon, to provide low reverse-leakage conditions.

ENQUIRY CARD AD. 14

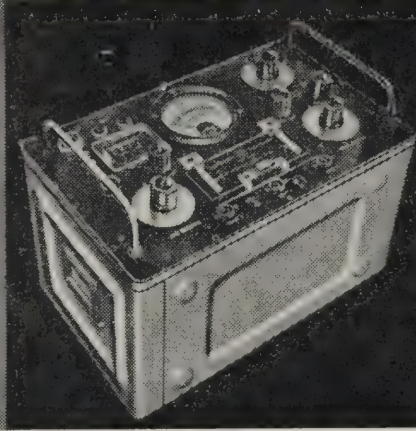


Accurate, dependable  
**Test Instruments** *you can trust*



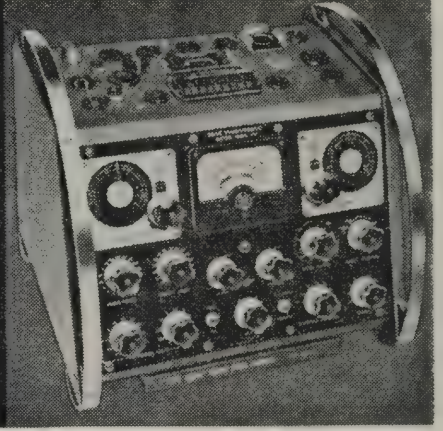
#### Avo electronic testmeter

A 56 range valve voltmeter for the electronic engineer capable of making a very wide range of measurements not normally covered by this type of instrument. The measuring circuits employ very high input resistances even when low voltage ranges are in use.



#### Avo Electronic Multimeter

This 95 range instrument consists basically of a highly stable balanced valve d.c. millivoltmeter with a full scale sensitivity of 250 mV, a radio frequency amplifier, voltage multipliers, shunts, wattage load circuits and a valve stabilised power supply.



#### Avo valve characteristic meter, Mk. IV

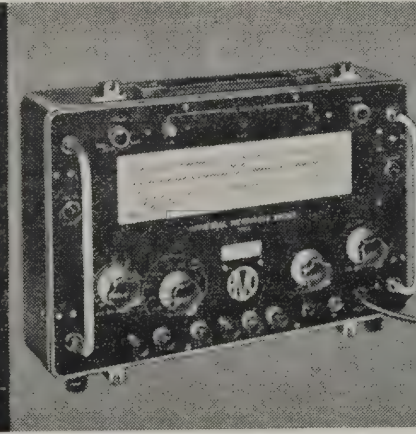
A most comprehensive bench type Valve Tester which will test most standard receiving and small power transmitting valves on any of their normal characteristics under conditions corresponding to any desired set of d.c. electrode voltages.



#### Avo valve Tester, Type 160

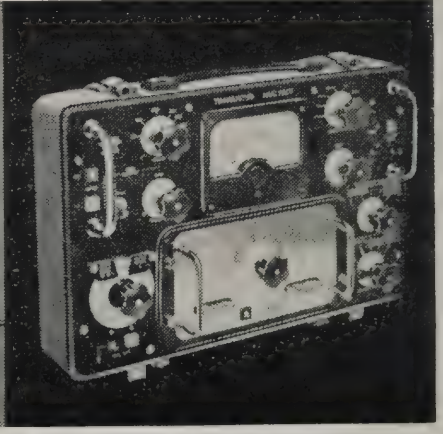
This portable instrument will check most standard receiving or small transmitting valves and will produce accurate readings of mutual conductance. It can be easily operated by an unskilled person.

*There is also a full range of AVO Measuring and Precision Instruments.*



#### Avo universal measuring bridge, Type 1

A self-contained mains driven model. This instrument has 24 calibrated ranges for the measurement of resistance, capacitance and induction.



#### Avo transistor analyser

A portable or mains instrument for measuring transistor parameters in the grounded emitter configuration. **Ranges:** Current: 0-100  $\mu$ A, 0-1mA, 0-10mA, 0-100mA, 0-1A. Voltage: 0-1.5V, 0-15V, 0-150V, with a sensitivity of 20k ohms. The movement is protected against damage by overloads.

A1.4

**NEECO THE NATIONAL ELECTRICAL AND ENGINEERING CO LTD**

AUCKLAND WELLINGTON CHRISTCHURCH DUNEDIN WHANGAREI HAMILTON ROTORUA NEW PLYMOUTH WANGANUI HASTINGS LOWER HUTT INVERCARGILL

# MOBILE COMMUNICATIONS

by Countryman\*

There is one field of communications, which gets practically no acknowledgement in print, and that is mobile communications, yet in this field New Zealand is, on a per capita basis, one of the most highly developed. Nowadays the sight of a car or truck with a VHF or MF aerial is so common that it raises no comment at all, which is, I suppose, a sort of back handed compliment to those who design, install and maintain the sets.

Mobile is a big field, and it is hoped in this series of articles to form a link for those engaged in the field. To that end, comment, paragraphs and information will be welcome.

The installation of a mobile radiotelephone can be one of the pleasures or exasperations of a technician's life. Some sets and vehicles seem to go together well, no trouble to install and tune up, easily suppressed, and a satisfied customer. Others — just the opposite. Those concerned with VHF installations probably do not experience this trouble very often since these sets usually work in areas of fairly high field strength, and motor noise if not entirely absent is certainly a good deal less troublesome at those frequencies. There are, however, many mobile systems working in the 2 to 3½ megacycle and 4½ to 5 megacycle region, and the technician who has to keep one of these going has his troubles. Field strengths can be very low where the range starts to get above 20 or so miles; in fact signals are soon down to the order of a microvolt or so. Couple this with the fact that even the best of engines is going to generate some radio noise and you have a

situation which is likely to drive the technician to drink.

Of course, a good deal of improvement could be achieved by using higher power base stations. In New Zealand base stations are limited to 50 watts input — say about 30 watts output. We can only envy our contemporaries in the United States and elsewhere who are allowed many times this power.

It is my impression that newer vehicles are much harder to suppress than the ones we used a few years ago. Maybe its because in those days the first of the modern type of radio telephone was just being introduced and we were so pleased with its performance that we were not as critical as we are now, but I really think that things have got worse. Certainly different makes of truck vary. I know of one fleet where the vehicles are of one piece all welded construction which are easy to suppress and give excellent results. At the same time another group uses a modern type of pick-up truck assembled with nuts and bolts, rivets, rubber bungs and self tappers, which simply cannot be suppressed properly. You can fit plug suppressors, regulator suppressors, coaxial condensers to the coil and generator, and then go around with heavy woven straps and bond **everything**, even running boards and diff housing and then find the noise is still exasperating. Complaints to the maker bring the reply that the truck meets the Standard Specification for suppression. Well, it probably does, since that is concerned with interference to radio and TV. sets in adjacent houses and call for not more than 5 microvolts per metre at 10 metres from the truck. Of course the good old inverse square law comes in here, and at the

truck you may well have about 50 microvolts per metre!

The only real solution to this problem is to shield the ignition system, and the American magazine "QST" has recently featured no less than four types of shielded ignition systems. This, coupled with an alternator type generator, transistorised regulator and careful shielding of all leads likely to cause interference can reduce noise to a low level. Of course this is likely to be pretty expensive, but where it has to be done — armed services vehicles for instance — it is done and that's that. The specification for radio vehicles in the armed services calls for not more than one microvolt of noise at the input to the receiver from an 8 foot vehicle mounted aerial with the engine running at cruising speed.

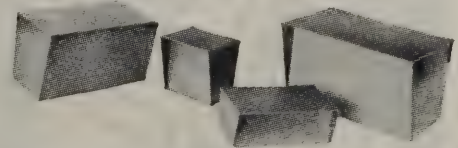
Perhaps this standard is too high for civilian use, but certainly there is scope for greatly improved means of suppression. It seems to me that there is an opening here for an enterprising N.Z. manufacturer to produce good suppression gear, and certainly if the technicians have anything to do with it, it should sell like hot cakes.

## ENQUIRY CARD AD. 16

### imlok miniboxes

Miniboxes provide a simple and inexpensive way of housing a wide variety of small pieces of equipment. They are of simple two-piece construction — one half forming the top and two sides; the other the back, base, and front panel.

The 'miniboxes' are available ex-stock in either steel or aluminium and vary in size from 5 3/64" x 5" x 3 11/16" to 7 3/64" x 12" x 6 9/64". Available in a variety of finishes.



### custom chassis

Blank chassis can be supplied custom-built to any requirement and in any available metal or alloy. These can be punched and drilled at request.

FOR FULL DETAILS CONTACT

**IMAREX (1960) LTD.**  
P.O. BOX 8642, AUCKLAND, C.3

\* a pen name for a New Zealander widely experienced in M.F. and V.H.F. communications systems.

## Constructional Data

# 5/8th Wavelength Vertical Mobile Antenna for 2 Metres

by Irving Spackman  
ZL1MO

Since the article which was published in the April 1964 issue of this journal, in which the note on the  $\frac{5}{8}$ th wavelength vertical was included, there has been considerable increase in overseas interest in the device, so much so, that one well-known English firm has produced a commercial version. The original American article did not give very much data on the design so a considerable amount of experimental work has been carried out on the device. In addition the author has been investigating ways and means of simply fabricating the antenna using readily available parts.

There is a cheap manufactured gutter mounting car aerial designed for use with transistor portable radios. This looked as though it might form the basis for a simple design for the  $\frac{5}{8}$ th vertical, provided that a loading coil could be inserted in the base section of the whip, which itself would need to be lengthened considerably. As it stands, with the



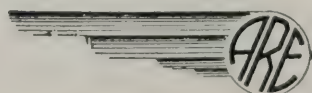
ENQUIRY CARD AD. 15

## PRINTED CIRCUITS

### AUCKLAND RADIO ENGINEERS

Offer the radio and electronic trade a complete printed circuit board service, from circuit to completed board, single boards or production runs made to your individual requirements.

For further information write to



Auckland  
Radio Engineers,

143a Hobson St., Auckland, or phone 34-410



**WE SUPPLY—**  
Transistors  
Valves  
Cathode Ray Tubes  
Rectifiers  
Technical  
Publications  
TV. Turret Tuner  
Resistors  
Capacitors  
Potentiometers  
Radio & TV.  
Components  
Philips Loud  
Speakers  
Philishave Spares  
TV. Aerials  
and Accessories  
Auto Aerials  
Special Cables  
and Conductors  
Printed Circuit  
Boards  
Professional  
Components  
Philips Replacement  
Parts  
TV. Kit Sets

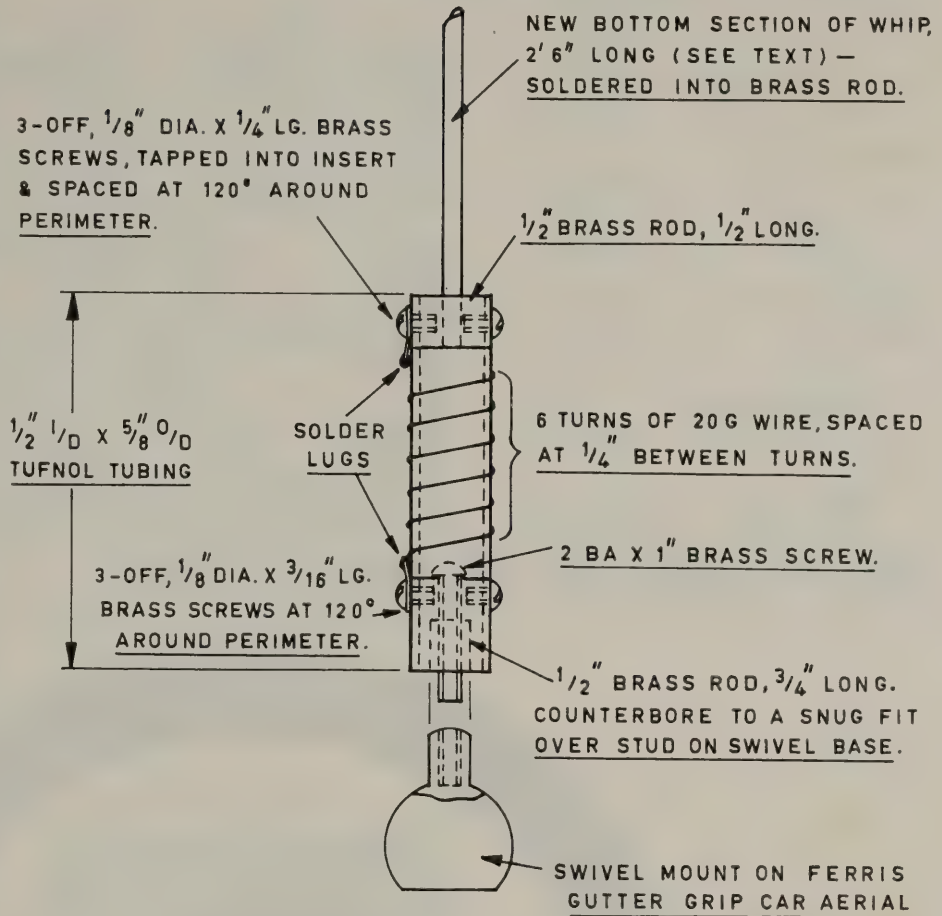
whip fully telescoped down from its full length of approximately three feet, to nearly 19 inches, it serves quite nicely as a simple  $\frac{1}{4}$  wavelength whip. However, its extended length of 3 feet was not long enough to form the basis of a  $\frac{3}{8}$ th wavelength whip.

Enquiries to the Auckland manufacturers of this antenna, Messrs Channel Master (N.Z.) Ltd. who make the aerial as the "Ferris Gutter Grip Aerial" brought to light the information that a longer base section of the whip is available. This base, 2' 6" long, plus the top section of the standard car aerial give an overall length of 46 inches, just what is required for the design. In addition the base section can be screwed into the swivel knuckle in the mounting clamp. It was therefore a simple matter to fabricate a small loading coil to fit onto this knuckle and accommodate the base of the whip.

The accompanying diagram gives details of the construction of the loading coil assembly. A piece of  $\frac{5}{8}$ th inch outside,  $\frac{1}{2}$  inch inside diameter tubing about 3 to 4 inches long is required. Two simple brass inserts are made, one for the top, into which the whip fits, and one for the bottom, which itself screws into, and fits around the tubular extension on the swivel section of the original base. The recessed bottom section of the mounting coil makes a secure joint to the knuckle, and also takes the strain from the securing screw.

In the case of the top mounting section, the author first drilled and tapped the insert so that the whip, which has a threaded portion on the bottom end, could be screwed into the top of the loading coil. This did not seem particularly robust, so the whip was permanently assembled using a large soldering iron and hard solder. This appears to have stood up to the weather and ravages of low tree branches amazingly well.

As was mentioned in the earlier article, the loading coil is best adjusted by putting on one or two extra turns, these being



DETAILS OF BASE LOADING COIL FOR  $\frac{5}{8}\lambda$  2-METRE WHIP, USING FERRIS GUTTER GRIP CAR AERIAL.

pruned and the spacing adjusted to provide optimum loading of the transmitter. The feedline supplied with the original antenna is 50 ohm cable, and is suitable feedline for this antenna. In the short length normally used for mobile work, the losses on this thin cable are not significant.

After the loading coil is adjusted, it should be protected from the weather, and road dirt etc., by a covering of plastic tape. There is available on the market at the present time, under various guises, P.T.F.E. tape which serves the purpose admirably.

In order to remove the thin top section from the standard whip, to fit it to the new bottom section the threaded collar is removed, and this releases the top section. Before replacing it in the top of the new base section of the whip, the split section of the top whip

should be spread carefully so that it makes a tight sliding fit on the inside of the base section. Then the assembly can be screwed together.

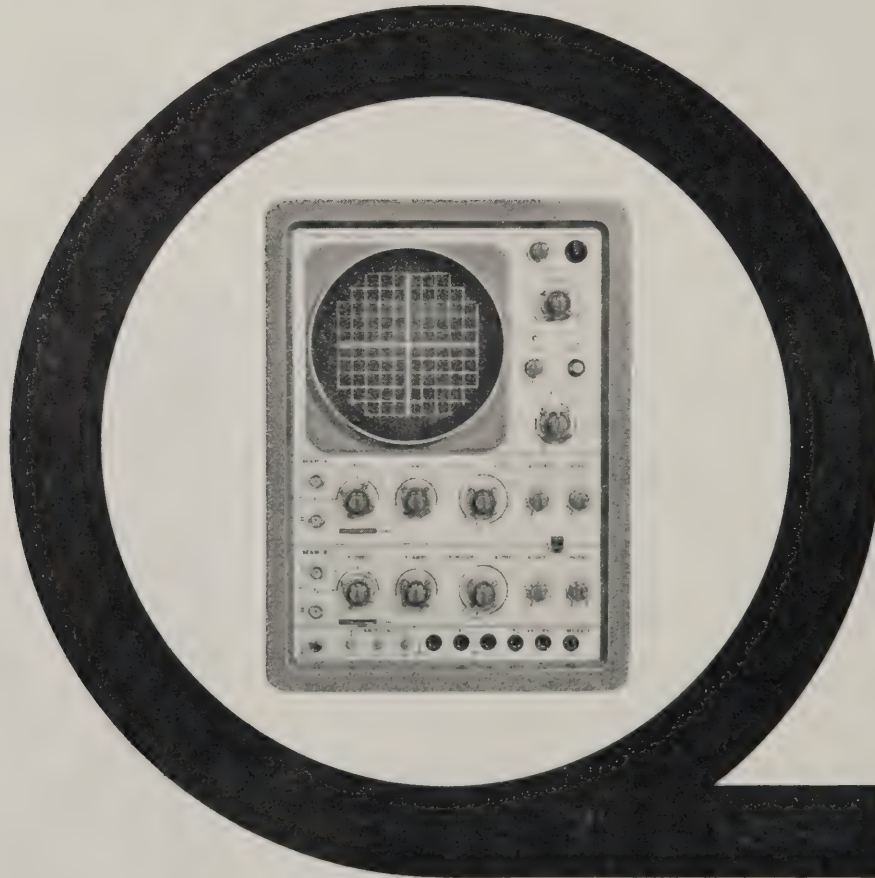
For garaging purposes, the whip can be retracted or folded back along the gutter of the vehicle. Incidentally when mounting the antenna on the gutter of the car, follow the instructions in this respect. In particular, the two mounting screws should make good "electrical" contact with the metal of the gutter, otherwise the antenna will not be working against the car body as a "ground plane."

For best operation, the antenna should be mounted near the centre of the car, with the feedline run down the gutter, and into the interior via the door or under the bonnet and through the fire wall.

## PHILIPS OSCILLOSCOPES

Type and Bandwidth	Max. Sensitivity	Input Impedance	Signal Delay	Sweep Speeds	Magnifier	CRT Dia.	Acc. Voltage
GM 5603 differential wideband d.c.-14Mc/s	50mV/cm	1 M $\Omega$ /22 pF	yes	0.2 $\mu$ s/cm-1s/cm	2X, 5X	13cm (5")	10kV
GM 5602 wideband d.c.-14Mc/s	50mV/cm	1 M $\Omega$ /22 pF	yes	0.2 $\mu$ s/cm-1s/cm	2X, 5X	10cm (4")	4kV
GM 5600X compact H.F. d.c.-5Mc/s	50mV/cm	1 M $\Omega$ /40 pF	no	0.5 $\mu$ s/cm-30Mc/s/cm	—	7cm (3")	1.6kV
PM 3201 H.F. d.c.-5Mc/s	10mV/cm	1 M $\Omega$ /35 pF	no	0.5 $\mu$ s/cm-0.2s/cm	5X	10cm (4")	3kV
GM 5601 H.F. d.c.-5Mc/s	100mV/cm	1 M $\Omega$ /30 pF	no	0.5 $\mu$ s/cm-0.2s/cm	5X	10cm (4")	3kV
PM 3236 double-beam L.F. d.c.-150kc/s d.c.-300kc/s	500 $\mu$ V/cm 20mV/cm	1 M $\Omega$ /70 pF	no	10 $\mu$ s/cm-5s/cm	2X, 5X, 10X	13cm (5")	4kV
GM 5659 X.Y. d.c.-1M	100mV/cm	1 M $\Omega$ /15-40 pF	no	2 $\mu$ s/cm-0.1s/cm	—	10cm (4")	2kV

*QUALITY ENGINEERED FOR QUALITY SERVICE*



The PM 3236 Double Beam Oscilloscope, brief details of which are given above, is a new addition to the Philips range, especially suitable for studying low frequency phenomena. This versatile instrument is available ex stock at a very attractive price.

For further information please contact:



# EDAC LTD.

P.O. BOX 6415, WELLINGTON

P.O. BOX 9338, AUCKLAND



## REFIT OF U.S. ELECTRONIC NAVAL SHIP

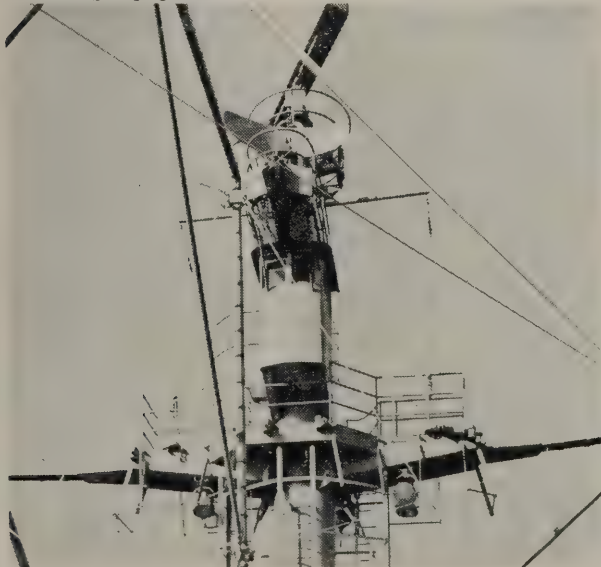
The value to N.Z. of a trained group of systems engineers experienced in installation of diverse electronic equipment was recently demonstrated. U.S. Navy representatives visited this country to evaluate facilities and personnel available to completely refit the U.S. Naval ship *Eltanin*. This vessel has been engaged on advanced research and survey work in this area for some time and will be employed in future on a programme of scientific research and exploration in Antarctic waters.

It was decided that technical personnel and facilities were available and A.W.A. (Australasia) N.Z. Ltd. was engaged to install sophisticated electronic research, communications, radar and navigational systems. The installation programme involved 3700 man-hours concentrated into six weeks. The refit was done in Auckland by personnel from Auckland, Wellington and Christchurch A.W.A. branches. Value of the installation contract was 17,325 dollars.

**Above.** AWA engineer John Cox making final adjustments to the 3 cm radar after completing the installation.

**Below:** High on the USNS *Eltanin* mainmast can be seen the two radar scanners. The topmast one works on 10 cms and the lower on 3 cm.

**Right:** USNS *Eltanin* festooned with aerials and radar scanners lies alongside an Auckland wharf. The electronic installations include upper atmosphere noise recording equipment.



# Book Review . . .

The new book we have for review "Generators in Industrial Electronics", edited by Sheldon Littwin, published by Illiffe Books Ltd., London, in February, 1965.

In recent times, pulse techniques have found increased numbers of applications in industry. In many countries, we could go so far as to say that the highest proportion of industrial control instrumentation and computation is basically using pulse techniques.

By them the nature pulses are ideally suited for encoding operating instructions for switching "on and off" electronic relays, and gating circuits for operating counting circuits and time-intervals measurements and they play an essential part in electronic computers. Consequently a sound

knowledge of pulse techniques has become essential to the industrial electronics technician or engineer. Unfortunately, most of the comparatively few books devoted to the subject are very advanced, and in many cases highly mathematical. In contrast, this particular book of some 126 pages, is practical, concise, clearly and simply written, well illustrated with over 100 diagrams and free from mathematics, thus this text is ideally suited as an introduction to what is generally regarded as a difficult subject. The book opens with a description of the two general classes of pulse generation circuits—passive (pulse shaping) and active (self-oscillating) then after defining the special terms used in connection with pulse techniques and discussing the characteristics of the various wave-shapes used for pulses, deals in turn with a wide

range of active pulse generators using transistors, diodes and vacuum tubes. The next chapter deals with clipping, clamping, and shaping circuits, with circuit diagram showing input and output signals. Chapter 3 discusses the design requirements for pulse amplifiers.

The next chapter is devoted to coincidence and counting circuits, whilst the fifth and final chapter discusses some of the applications of pulse techniques in industry.

At the conclusion of the text there is a list of references for further reading and an adequate index. At the end of each chapter, there is a series of review questions which make the book useful as a text for teaching purposes.

Our copy was received direct from and by courtesy of the Publisher.

## INSTRUMENTS FOR COMMUNICATIONS EQUIPMENT

Continued from page 15

frequency-measuring coverage of from 50c/s to 250kc/s. Alternatively, an outside frequency source can be used as the "known" frequency.

### ENQUIRY CARD AD. 21

*Radio  
Mr<sup>A</sup> Serviceman*

*Our radio broadcast universal replacement coils will replace any damaged aerial, R.F. or oscillator coil. Designed to assist you in maintaining first-class service to your clients.*

*Aerial Type 40*

*R.F. Type 45*

*Osc. Type 41*

*Write for alignment procedure  
Sheet No 5/40*

**New factory address:**

*Cameron Rd. South, Greerton, Tauranga*

**Inductance Specialists LTD.**

From Dawe Instruments comes an audio sweep generator, covering 20c/s to 20kc/s on a single, logarithmic scale. Provision is made for the frequency control, a specially designed variable capacitor giving true logarithmic frequency change, to be motor-driven to give continuous sweep. The instrument can thus become the heart of an automatic system for the study of almost any audio or vibration problem. The oscillator has the unusually high output of 2.5 watts and a very low distortion figure.

### Oscilloscope System

The oscilloscope is looked on as a basic tool of the communications engineer; although digital and metered instruments have to some extent taken the place of the oscilloscope, it is still essential in most testing and monitoring activities. One of the latest is the Solartron CD-1400 oscilloscope system, consisting of a basic display unit and power supply and with housing for two Y-units and one X-unit in plug-in form. A variety of amplifiers are available, including a wideband Y-amplifier (DC to 15Mc/s) with maximum

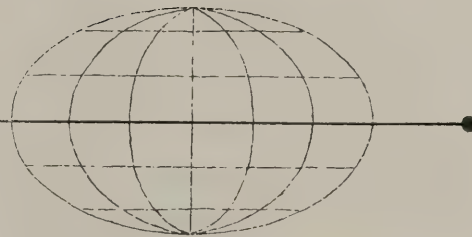
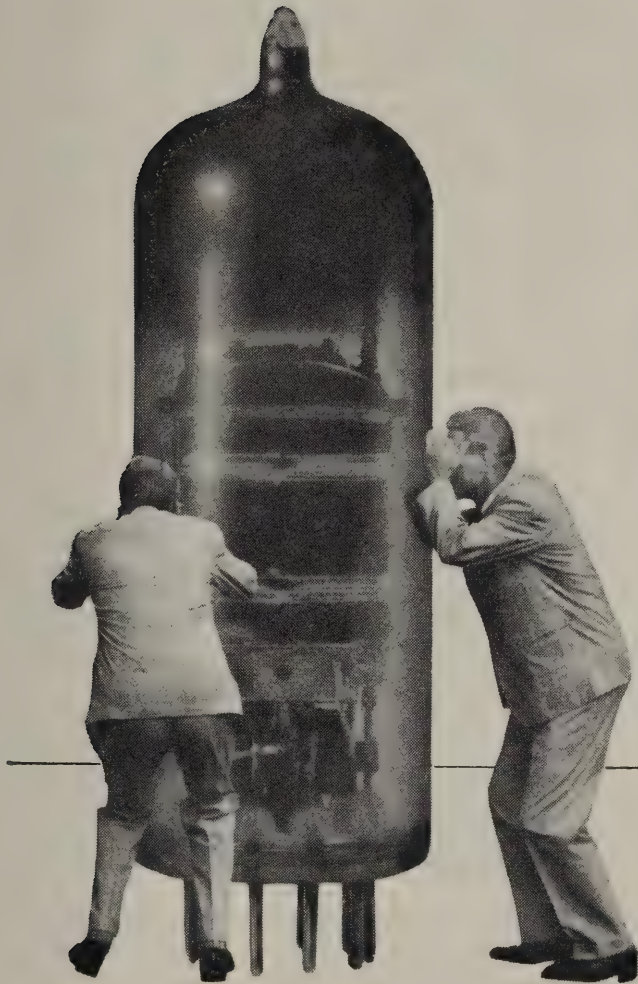
sensitivity of 100 mV/cm and a high-gain differential amplifier.

Although most oscilloscope work is carried out visually, the use of cameras to record the trace has introduced several novel pieces of equipment. Telford Products markets a complete assembly, to fit most oscilloscopes, which incorporates a viewing hood that allows the operator a binocular, parallax-free view of the screen even when the camera is in use.

Measuring equipment which indicates the performance of data transmission circuits is soon to be manufactured by the M.E.L. Equipment Company. The instrument, which conforms to British General-Post-Office requirements, consists of a transmitter, to originate test signals, and a combined receiver capable of measuring bias and peak distortion of the signals and counting the number of signal elements received in error during the test. Errors are detected by comparing the outgoing signal with the received signal and the total number of errors is shown on a binary counter.

ENQUIRY CARD AD. 18

# what do you see when you look into this tube...?



## A WORLDWIDE ORGANISATION

Look hard - really hard, for behind every Miniwatt trademarked tube stands a worldwide organisation of repute and renown. An efficient organisation with top-ranking scientists in metallurgy, chemistry, electronics, physics..., vast laboratories..., thousands and thousands of specially trained workers... experience of many years of manufacturing... and these are but a few aspects of what goes into producing tubes of top-quality..... Miniwatt tubes. What does this mean to you?

## YOUR GAIN!

And not only your gain - but your customers' as well! For your customers rely upon you to do a good job when their sets need repair. And satisfied customers will come back and buy from you again and again. Miniwatt makes for satisfied customers. They know they can rely on you, you know you can rely on Miniwatt... always to have the right tube in stock... always a guaranteed top quality .. and to render you the service only a leading manufacturer can - both now and in the future!

A WORLDWIDE ORGANISATION IS BACKING UP YOUR BUSINESS



# PHILIPS MINIWATT

# INDEX — VOLUME 19

<b>A</b>			
Aerials, VHF	Sept. 64	p. 14	
	Oct. 64	p. 16	
Amplifier, audio specifications, capabilities and measurements	June 64	p. 13	
	July 64	p. 9	
<b>B</b>			
Bridges, AC and Graphical solutions; Mayes, C. W.	Dec. 64	p. 26	
Broadcasting House, NZBC	April 64	p. 24	
	May 64	p. 30	
<b>C</b>			
Cathode Ray Tube, unusual electrostatic focus; Groves, K. E.	June 64	p. 33	
Coil Data, VHF mobile equipment	Sept. 64	p. 29	
Communication Receivers, how to repair; King, T. C.	Feb. 65	p. 24	
Communication and optical frequencies	March 64	p. 30	
Computer, British Invention reads directly; Handel, S.	Jan. 65	p. 26	
Convactor (Power), simple transistor	Sept. 64	p. 12	
Crystal set, Philips super de luxe	Nov. 64	p. 18	
<b>D</b>			
Data recording, magnetic tape; Watts, P. L.	Nov. 64	p. 24	
	Dec. 64	p. 15	
Diodes, high power varactor	May 64	p. 9	
<b>F</b>			
Facts, getting them right and quickly; Walker, J. S.	Dec. 64	p. 27	
Frequency Standard, N.Z., Gerard, V. B.	Dec. 64	p. 9	
Frequency Standard, U.S.	March 64	p. 33	
<b>H</b>			
Hall Effect; Spackman, I. H.	April 64	p. 28	
<b>L</b>			
Line output tube, 6GJ5 in amateur R.F. Service	Feb. 64	p. 28	
<b>M</b>			
Magnetic Core memories	April 64	p. 16	
Meter, direct reading audio frequency; Salmon, C. W.	May 64	p. 12	
Microelectronics; Baker, W. J.	Nov. 64	p. 9	
Microphone sensitivity chart	Oct. 64	p. 11	
Museum of transport and technology	Oct. 64	p. 14	
<b>O</b>			
Oscillator, low distortion audio	June 64	p. 11	
	July 64	p. 12	
Oscillator, transistorised grid-dip	Aug. 64	p. 13	
<b>P</b>			
Periodicals technical, making the most of; Eastel, E. R.	Oct. 64	p. 32	
Power amplifier, medium fi transistorised	Dec. 64	p. 12	
Power source, useful low voltage; Spackman, I. H.	July 64	p. 30	
Power supply, transistorised; Spackman, I. H.	May 64	p. 27	
Power supply, versatile regulated; Lister, M.	Sept. 64	p. 24	
Power unit, for transistor receivers; Jones, B. S.	Dec. 64	p. 18	
<b>R</b>			
Receiver, broadcast, "Three plus R"	Nov. 64	p. 27	
Receiver, transistorised communication for mobile or home; Spackman, I. H.	Aug. 64	p. 15	
Relay, sensitive transistorised high current	April 64	p. 17	
Relays versus semiconductor devices, a comparison	Sept. 64	p. 9	
<b>S</b>			
Satellite information	Feb. 65	p. 33	
Satellites, problems and prospects for communication systems; Pandoe, G. K.	Oct. 64	p. 29	
Science Congress, 11th N.Z.	Feb. 65	p. 7	
	Feb. 65	p. 26	
Semiconductor rectifiers, medium power	Jan. 65	p. 9	
	Feb. 65	p. 16	
Signal generators; Mayes, C. W.	Oct. 64	p. 23	
Solar radio noise monitor; Manchester, R. N.	Jan. 65	p. 13	
Sound, noise and loudness	March 64	p. 16	
Sound and TV services, planning and propagation of VHF and UHF; Vickers, G. A.	March 64	p. 12	
	April 64	p. 9	
	May 64	p. 16	
Space link; Wheeler, R.	Dec. 64	p. 31	
Sweep generator, TV	April 64	p. 33	
S.H.F. radio link comes of age; Anderson, E. W.	July 64	p. 26	
<b>T</b>			
Telecommunications, looking at future of	Aug. 64	p. 9	
Television, colour; Watts, P. L.	July 64	p. 14	
Television Receiver, 6" experimental; Spackman, I. H.	Nov. 64	p. 13	
	Jan. 65	p. 16	
	Feb. 65	p. 9	
Television transmitting station, planning of	June 64	p. 25	
Translator, "Oscar" 2 metre	Feb. 65	p. 31	
Transmitter, 50kW high efficiency; Bowers, D. F.	Aug. 64	p. 24	
Tuner, transistorised hi-fi; Spackman, I. H.	Oct. 64	p. 8	
<b>V</b>			
VHF, extended range; Rider, G. C.	Jan. 65	p. 27	
VHF, some aspects of mobile operation; Spackman, I. H.	March 64	p. 8	
	April 64	p. 12	
	May 64	p. 25	
	June 64	p. 16	
Vibrator tester, serviceman's; Stokes, J. W.	July 64	p. 24	
<b>SERVICE DATA &amp; CIRCUITS</b>			
AWA B17 and B18 transistorised receivers	April 64		
AWA TX31 series TV models 2L272 and 2C272	January 65		
AWA TV models ZL, ZC, DZ, FC & SC S2	September 64		
Autocrat Vega Altair TV receiver	August 64		
Bell 5D63 stereo receiver	July 64		
Murphy P87 Olympic receiver	February 65		
Murphy VCG343 TV receiver	June 64		
Philips L3290T transistor portable	December 64		
Philips HM324C and 325C TV receivers	May 64		
Pye TCR 1005 and 2005 car radios	November 64		
Ultimate Ekco RER transistor receiver	October 64		
Ultimate Ekco REH radiogram	March 64		

## ELECTRONICS TECHNICIANS

Continued from page 18

is the goal toward which the middle group now known overseas as "Technician Engineers" (a term approved by the European, Commonwealth and U.S. Engineering Institutes) must aim. The formation of the Engineering Associates Registration Board has been viewed by many middle group men with some degree of suspicion, as there is a feeling that it may be designed as a safety valve to take the pressure for recognition of the newer technologies off the older institutes. Indeed both the Surveyors and Marine Engineers are struggling hard to retain professional recognition. The definition of Technician Engineer is a person who "applies engineering methods in a specific field," and by this definition the above groups are certainly described.

For the Technician Engineer then we have an exam and registration, but as yet no organisation. Many technicians will say — well,

what do we need an institute for? To reduce it to its lower level it means that we will have a body to make sure that we have a say in our fate, because as it stands we can at the moment not be heard in any discussion which will affect our welfare. We need only look at the Engineer's institute, and the British Medical Association (surely the most powerful group of technicians) to see what can be achieved by co-operation. At a higher level, an institute would be able to establish standards of conduct, performance and recognition which would ensure that the Technician Engineer could take his place in the engineering profession.

The time is now ripe for the formation of the "N.Z. Institution of Technician Engineers". Such an institute could embrace at various grades all those engaged as technicians and technician engineers, not only in electronics, but all branches of engineering. But the effort can only start with one person . . . YOU.

## MASS SENSOR FOR SPACE USE

### To Build Mass Sensor for Space Use

A contract to develop a device that will sense the mass of an object at a distance by detecting its gravitational field has been awarded to the Hughes Research Laboratories by the National Aeronautics and Space Administration of America.

The £65,000 16-month contract, which covers the first phase of a research programme on gravitational mass sensors, calls for building a research model to measure the mass of a moving object within a room.

The programme's goal is the development of a small, lightweight, rugged sensor that can be carried on lunar orbits to measure the mass distribution of the moon, and for use on deep space probes to measure the mass of asteroids.

The sensor will consist of an aluminium cruciform about 5in. in diameter that rotates within a vacuum chamber. When the sensor is rotated within the gravitational field of an object, it is explained, the pull of the object on the ends of the cruciform varies with the change in position caused by the rotation. This sets up vibrational modes in the sensor that can be read out by highly sensitive piezoelectric strain transducers and measured in terms of the object's mass.

CUT HERE

## ADVERTISEMENT & PRODUCT ENQUIRY SERVICE

TO OBTAIN MORE INFORMATION ABOUT PRODUCTS OR SERVICES MENTIONED IN THIS ISSUE FILL IN ITS NUMBER, YOUR NAME AND ADDRESS, CUT OUT THE COUPON, AND POST IT.

1st FOLD

If you require your own subscription postage free each month fill in here — we will invoice you.

Please send me

**RADIO, ELECTRONICS AND COMMUNICATIONS**

for

12 months — 30/-  
24 months — 50/-

NAME .....

ADDRESS .....

AUTHORITY No.  
1231  
AUCKLAND, N.Z.



**BUSINESS REPLY POST**

Postage will be paid by  
**THE MAGAZINE PRESS LTD.**

**P.O. BOX 1365**

**AUCKLAND**

3rd FOLD

2nd FOLD

FIX HERE



### BRITISH ELECTRONIC MUSCLE FOR ITALIAN AIRCRAFT

Carefully, skilfully, a British technician assembles a quadruplex hydraulic actuator.

This piece of electronic fantasy could easily be called one of the many "elec-

## New Products

tronic muscles" which automatically control the aileron action and "puff-pipe" angle on vertical take-off and landing (VTOL) aeroplanes.

The unit has a built-in failure factor which allows for one failure in the system and the unit will continue operating.

A second failure — and the unit has a better-than-average chance of still operating. And the actual failure survival rate is better than one failure in ten million landings.

This unit is one of two included in the autostabiliser system fitted to the Italian Fiat G.95 VTOL aeroplane.

**ENQUIRY CARD 137**

\* \* \*

### NEW REAR-WINDOW CATHODE RAY TUBE

A new seven-inch cathode ray tube, type WX-30027, with a two-inch-diameter rear window is now available from the Westinghouse Electronic Tube Division. A radar image can be displayed on the flat face of the tube at the same time a photographic recording of the image is made through the optically flat rear window. Rugged construction makes the tube suitable for airborne applications. A cascade screen is used in the WX-30027. As a result, blue light is emitted to the rear for photography and

yellow light is emitted to the front for visual observation. The electron beam spot size is 10 mils. The WX-30027 can be mounted in any position. It weighs about eight pounds. Maximum half-angle magnetic deflection is 17 degrees.

**ENQUIRY CARD 136**

\* \* \*

### A MOST ADVANCED SPECTRUM ANALYSER AVAILABLE

Hewlett-Packard announce an instrument which can simultaneously display every short-wave broadcast on the air, using only a tenth of its capacity.

The instrument is a spectrum analyser having twenty times the range of any such device previously offered for general sale.

On a cathode ray screen, somewhat like that of a radar set, it will display as if on a graph every short-wave transmission that is on the air in its location. Neat bright lines, spread across the screen, measure the strength, the content, and the frequency or dial position of each radio signal. Not only will it show every VHF television station and every FM station which may be broadcasting at a given time, it will also show the many other radio signals which crowd the air nowadays. Aviation radio beacons, maritime communications stations, international short-wave broad-

## Radio, Electronics and Communications

☐ Please send me, without obligation, information on the item numbers listed below.

☐ Please record my subscription as detailed on reverse side.

This card is valid for three months from date of publication.

The FREE Postage does not apply to overseas readers.

Ref. No. .... Ref. No. .... Ref. No. ....

Ref. No. .... Ref. No. .... Ref. No. ....

Ref. No. .... Ref. No. .... Ref. No. ....

Other .....

Your Name ..... Position Held .....

Name of Firm .....

Address .....

Nature of Business .....

**BLOCK CAPITALS PLEASE**

**FREE  
READER  
INFORMATION  
SERVICE**

For more information on

- ADVERTISEMENTS
- NEW EQUIPMENT  
AND MATERIALS
- NEW LITERATURE

fill in the Enquiry Card number of the advertisement or product you are interested in and we will forward it to the company concerned.

**APRIL, 1965**

casts, mobile radio-telephone signals, radio amateurs, and many others all use the radio spectrum simultaneously.

The thing that is so remarkable about Hewlett-Packard's new analyser, however, is its ability to "sweep," i.e. simultaneously to display, ten times the range necessary to show all those radio signals. It can measure all these signals at once on only a tenth of its screen, then add the whole 82-channel UHF television band, some radar stations, and satellite communications broadcasts, and still have half the screen available to show 1000 megacycles of the microwave band. Previously produced instruments of this kind give a much narrower view. It would take twenty of them to do the same things the new instrument can do by itself. It can also quickly narrow down its view, and give a magnified image of any small part of the electronic scene.

Sweep bandwidths up to 2 Gc from 10 Mc to 40 Gc, accurately calibrated dynamic range of 60db, and sensitivity to -100dbm are features of Hewlett-Packard's new Model 851A/8551A. Spectrum width accuracy is  $\pm 5\%$  from large increase in the scope, speed, and accuracy of spectrum monitoring, spectrum signature identification, and RFI analysis. Although it weighs less than 140 pounds and occupies only 19 inches of rack space, in some applications it can replace many racks of receiver equipment.

By contrast with previous analysers, all basic functions are fully calibrated. Spectrum width accuracy is  $\pm 5\%$  from 100 kc to 3 Mc,  $\pm 5\%$  at 10 Mc, and  $\pm 4\%$  from 30 Mc to 2 Gc. Sweep rate may be set with 2% accuracy. Resolution is adjustable, manually or automatically, at 1, 3, 10, 100, or 1000 kc. Even over the 2-Gc sweep, frequency response is specified at  $\pm 5\text{db}$ . The vertical display is also calibrated: log, 60db  $\pm 2\text{db}$ ; linear, 70:1  $\pm 5\%$ . A new internal RF input attenuator has zero insertion loss at DC and less than 2db at 10 Gc.

An internal-graticule crt is used to eliminate parallax, and a base-line clipper can eliminate the base line to facilitate the viewing of fast pulses and to prevent fogging of the film when the display is photographed.

#### ENQUIRY CARD 132

\* \* \*

#### FUEL CELLS POWER TV. SET DIRECTLY FROM COAL

PITTSBURGH, Pa., U.S.A. — At the Westinghouse Research Laboratories a standard television set is operating directly from a handful of powdered coal.

Westinghouse research engineers are using the experiment to demonstrate an experimental 100-watt fuel cell system which converts gases from the coal directly into electricity.

The system was developed under a research contract with the Office of Coal Research, U.S. Department of the Interior. The contract is aimed at the

eventual development of a practical, large-scale coal-burning fuel cell system for electric power generation. Such large-scale fuel cell power plants will, however, not develop until large plants for generation of DC power have been built. Electrolytic industries will probably be the first commercial users of such cell systems.

The experimental system consists of a fuel cell battery having 400 thimble-size fuel cells, plus a chemical reactor for producing volatile gases from the coal fed into it. Both the reactor and battery operate at high temperature — 1800 degrees Fahrenheit.

#### ENQUIRY CARD 134

\* \* \*

#### TWO NEW GARRARD MODELS FOR THE ENTHUSIAST

The Garrard model 301 Transcription Turntable is one of the best known quality turntables at present available in this country. But apparently the best can always be bettered for now we have the MODEL 401 TRANSCRIPTION TURNTABLE shortly becoming available.



The 401 incorporates many of the features found in the earlier 301 but the styling has been considerably updated and the "top" appearance is very pleasing; in particular the operating knobs are better placed than in the 301. The whole unit is finished in a charcoal shade with chrome relief.

Three speeds are selectable and 110 or 230 volt operation is available. The deck is 13 5/8" wide by 14 9/16" deep with the "works" 4" below the deck and a height above deck of 2 1/8". The turntable is diecast, weighing 6lb. Wow and flutter are said to be less than .05% R.M.S. Speed variation of  $\pm 2\frac{1}{2}\%$  is possible and built in stroboscopic illumination is a feature of value.

The other new Garrard production is their model LAB 80 TRANSCRIPTION TURNTABLE WITH AUTOCHANGER. In this unit, available with two speeds (45 or 33 1/3rd r.p.m.), the overarm has been eliminated but 8 records of any one size can still be stacked for automatic use. Manual operation is also possible. The wooden tone arm supplied will accept any low mass cartridge. A cueing device and auto trip are standard features with this unit which is supplied in dark green finish. Width is 16 3/4", depth 14 1/2", height above the desk is



5 1/2" and the projection below is 3 1/2". Four tab controls — speed — manual — auto — record size — sit along the front of the deck.

For those who wish to have transcription quality with auto features the LAB 80 will fill a need.

#### ENQUIRY CARD 152

\* \* \*

#### WAVE TUBE OFFERS MORE RANGE

A travelling wave tube developed and just introduced by a British firm offers more channels and longer range in the telecommunications microwave field — because of its 100 per cent increase in power output. The new tube has a saturated output power of 20 watts which enables a wider bandspread to be used for extra channels or a longer link distance, without any increase in distortion. The tube also offers a cheaper replacement service, for a new tube can be fitted, using the existing mount, and only simple realignment is needed. The tube simply slides into the existing magnet — whereas in the past the magnet has also had to be replaced.

#### ENQUIRY CARD 133

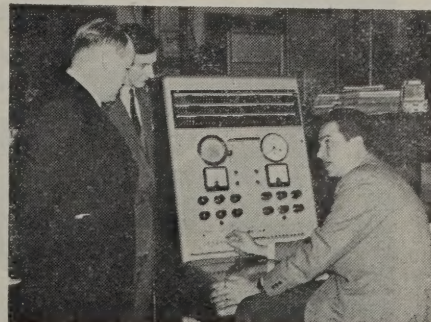
\* \* \*

#### FINNISH AIR FORCE USES MARCONI EQUIPMENT

Seen below examining a Marconi radio telephone terminal, type HW23, are two members of the Finnish Air Force, who recently paid a visit to the Marconi Company to discuss communications equipment.

The visit followed a recent order placed by the Finnish Air Force for three of these radio terminals, which have been designed to interconnect h.f. radio circuits with inland telephone networks. Fully transistorized, they use plug-in printed wiring modules, and provides all necessary technical control and supervisory facilities.

#### ENQUIRY CARD 129



### MARCONI DOPPLER FOR N.Z. AIRLINE

Air New Zealand have ordered Marconi AD560 Doppler navigation equipment for their new fleet of DC8 jet airliners. The AD560 is the latest of a series of Doppler equipment manufactured by the Marconi company for civil and military use. This transistorised, third-generation Doppler navigator has already been selected by a number of leading airlines using Boeing 707 and VC10 jets.

The AD560 electronically measures aircraft ground-speed and drift-angle to a high order of accuracy. In the DC8 installation a Marconi track-guide navigation computer will work in association with the Doppler velocity sensor. It will show how far the aircraft has to go to reach the next designated reporting point, and will also tell the pilot whether he is maintaining the planned track. Information from this navigation equipment can also be fed into the flight system and to the automatic pilot.

Major application of airborne self-contained navigation systems like the AD560 is on long-haul air routes where ground-based aids are not available, or do not provide sufficiently accurate information, to assist the air-crew in maintaining a flight plan. Air New Zealand has arranged that the heading reference for their DC8's will be provided by a

new accurate gyro-magnetic compass.

Negotiations were conducted through A.W.A. and arrangements have been made so that airline and Marconi engineers work in close co-operation.

Enquiry Card 146.

### PULSE TACHOMETER FROM WESTINGHOUSE

Accurate measurement of speed down to zero can be obtained with a pulse tachometer available from the Westinghouse Relay-Instrument Division. The zero-speed pulse tachometer, for digital instrumentation systems used in automatic warehousing application and machine tool position indications, provides a square wave pulse output of 10 volts per pulse into 10,000 ohms regardless of rotational speed.

Photoelectric principle is applied to the pulse tachometer to achieve analog to digital conversion. Both unidirectional, with an output of 250 pulses per revolution, and bidirectional, with an output of up to 1000 pulses per revolution, types are available. The bidirectional type contains a phase-sensitive network for direction-sensing application.

Both pulse tachometers have a maximum speed of 10,000 rpm, and operate from 120 volts 50/60 cycles at -20 to -60 degrees centigrade, consuming only 10 watts of power. Other features in-

clude a cast, splashproof housing that provides a sturdy and stable mounting for the pulse wheel pick-up and a mounting bracket that gives innumerable ways to mount the tachometer into a machine tool. A cast cover provided with a gasket completes the splashproof enclosure for the internal components.

Enquiry Card 139.

### UNIVERSAL MEASURING BRIDGE

The Philips PM 6301 measuring bridge is designed for resistance, inductance, and capacitance measurements; and to indicate their percentage difference from an appropriate standard. Compensation is possible for the effect of capacitor losses and coil quality on bridge indication.

Bridge circuitry is conventional, using the Wheatstone bridge for resistance, the Scuty bridge for capacitance and the Maxwell bridge for inductance. Resistance is measured by a direct voltage, whilst two bridge frequencies are available for the measurement of capacitance and inductance. Bridge balance is obtained by using the range switch as a coarse adjustment, whilst fine adjustment is obtained with a fine balance variable.

The sensitivity of the detector-amplifier is adjustable, so that it may be increased as balance is approached.

Enquiry Card 154.

ENQUIRY CARD AD. 22

ENQUIRY CARD AD. 23

## NEWS FROM PHILIPS

WE HAVE JUST RECEIVED A FURTHER SHIPMENT OF THE EVER POPULAR

## PHILIPS VALVE POCKETBOOK 1963/64

REASONABLY PRICED AT 5/- each

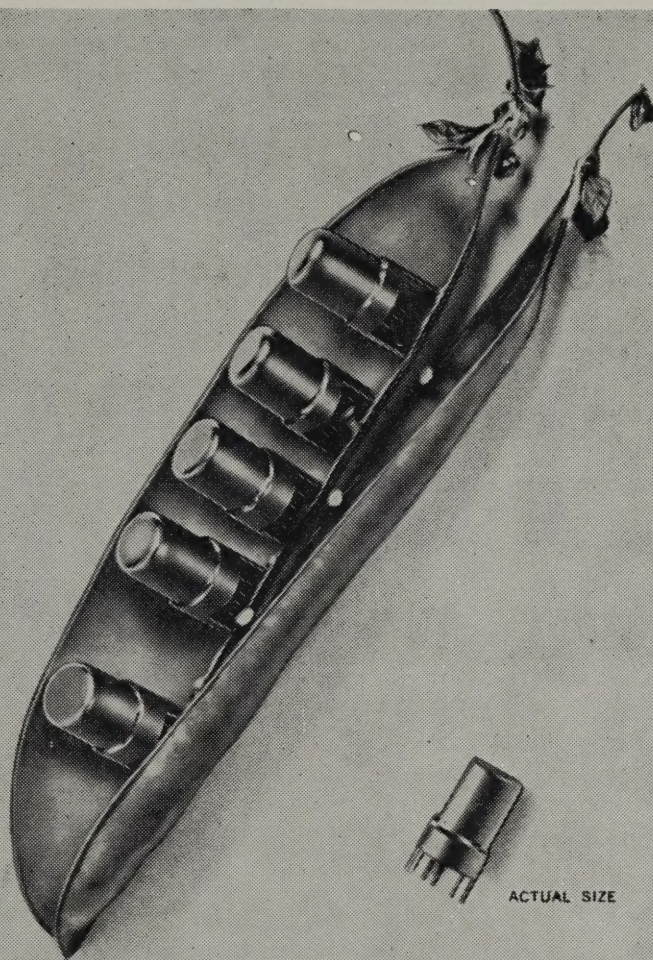
- ★ ELECTRON TUBES      ★ SEMICONDUCTORS
- ★ COMPONENTS        ★ MATERIALS

ORDER NOW WHILE STOCKS LAST, FROM YOUR LOCAL RADIO DEALER OR WHOLESALE

PHILIPS ELECTRICAL INDUSTRIES  
OF NEW ZEALAND LIMITED



ENQUIRY CARD AD. 19



# uniformity...

## another proven benefit of the RCA nuvistor

Nuvistor circuits are virtually free of replacement mismatch problems.

Because nuvistors seldom require replacement. Findings from over 1,600,000 hours of actual life tests of RCA-7586 nuvistor triodes have established a failure rate of only 0.47% or less per 1000 hours—for the first 10,000 hours of operation—at a confidence level of 95%.

Because the nuvistor you use will match the performance characteristics of the one it replaces. In addition, extended life tests also prove nuvistor characteristics are exceptionally stable throughout life. Note the tight range of transconductance values for each tube listed at right. Most important to you is the fact that no nuvistor tested either exceeded or fell below its initial specified gm range values during the first 2,000 hours of tests.

### NUVISTORS FOR DESIGN OR REPLACEMENT APPLICATIONS IN INDUSTRIAL, COMMERCIAL OR MILITARY SERVICE

Type No.	Description	Transconductance Range Values* (micromhos)	
		Max.	Min.
RCA-7586	general-purpose medium-mu industrial triode	13,000	10,000
RCA-7895	general-purpose high-mu industrial triode (mu 64)	10,900	7,900
RCA-7587**	general-purpose sharp-cutoff industrial tetrode	12,200	9,000
RCA-8056	medium-mu triode for low voltage power supply and small-signal amplifier applications up to 350 Mc.	8,000	6,000
RCA-8058	double-ended high-mu triode for cathode-drive amplifier service up to 1200 Mc.	14,800	10,000

\*with 6.3 volts ac or dc on heater \*\*tetrode, dc grid #2 volts = 50



**AMALGAMATED WIRELESS (Australasia) N.Z. LTD.**

2nd Floor, Commerce House, Wakefield Street, P.O. Box 830, Wellington. Tel. 43-191  
AUCKLAND CHRISTCHURCH PALMERSTON NORTH DUNEDIN



VR.22

ENQUIRY CARD AD. 20



## SILICON DIODE POWER TRANSFORMERS AVAILABLE FROM BEACON RADIO LTD.

### R98 T.V. POWER TRANSFORMER

For R.T.V. & H. 1959 and later T.V. Sets.  
Delivers 260v @ 300mA D.C. Full wave voltage doubler.

230:115v A.C. @ 300mA D.C.  
:12.6v C.T. @ 5A (2 windings ea. 6.3 @ 5A).  
:0—6.3—7.5—9 @ .6A. Picture tube winding.

Choke:—C36. Use 400v P.I.V. Diodes.

### R103 Stereo Power Transformer

R.T.V. & H. Aug. 60. 7w Stereo.  
230:245v @ 150mA D.C.  
:104v @ 150mA D.C. Voltage doubler Rect.  
:6.3v C.T. @ 5A.

Choke:—C42. Use 400v P.I.V. Diodes.

### R104 Stereo Power Transformer. 10w

320v @ 320mA. Voltage doubler Rect.  
230:130v @ 320mA.  
:6.3v @ 6A.

Choke:—C49. Use 500v P.I.V. Diodes.

### R105 T.V. Power Transformer For Philips T.V. Kits

220v @ 420mA D.C. Voltage Doubler Rect.  
230:106v @ 420mA D.C.  
:6.3v @ 10A.  
:0—6.3—7.5—9 0v @ 0.3A. Picture tube Winding.

Choke:—C45. Use 400v P.I.V. Diodes.

### R106 T.V. Power Transformer for Philips T.V. Kits

This type similar to R105 but less Picture Tube boost taps. Main Fils. 12.6v C.T. @ 5A.  
220v @ 420mA D.C. Voltage Doubler Rect.  
230:106v @ 420mA D.C.  
:12.6v C.T. @ 5A (2 windings 6.30v @ 5A each).

:6.3v @ .3A Picture tube winding.  
Choke:—C45. Use 400v P.I.V. Diodes.

### R108 Small Stereo Headphone Power Transformer

250v @ 22mA D.C.  
230:110v @ 22mA D.C. Voltage doubler Rect.  
:6.3 @ 0.86A.  
Choke:—C41. Use 400v P.I.V. Diodes.

### R110 T.V. Power Transformer. For Philips T.V. Kits

This transformer uses full wave bridge rectifier. Requires no limiting resistor unlike equivalent voltage double types, also has advantage of no insulated capacitor and lower ripple output with smaller choke.

Output 220v @ 420mA D.C.  
230:172v @ 420mA D.C. Full wave bridge Rect.  
:12.6v C.T. @ 5A (2 only 6.3v winding @ 5A).  
:6.3v @ .3A Picture tube winding.  
Choke:—C50. Use 400v P.I.V. Diodes.

### R111 T.V. Power Transformer

Similar to R110 but for R.C.A. type Kits.  
260v @ 350mA from Rect.  
230:207v @ 350mA D.C. Full wave bridge Rect.  
:12.6v C.T. @ 5A (2 only 6.3v windings each 5A).  
:6.3v @ 0.6A. Picture tube winding.  
Choke:—C42. Use 400v P.I.V. Diodes.

### R112 Oscilloscope Power Transformer

R.T.V. & H. 1963. Calibrated.  
230:110v @ 80mA D.C. Full wave voltage doubler.  
:6.3v @ 2.4A.  
:6.3v @ 1A.  
:6.3v @ 1A.  
Use 400v P.I.V. Diodes.

# BEACON RADIO LIMITED

Corner Brown and Fitzroy Sts., Ponsonby, Auckland. P.O. Box 2757. Telephone 16-164 (3 lines)